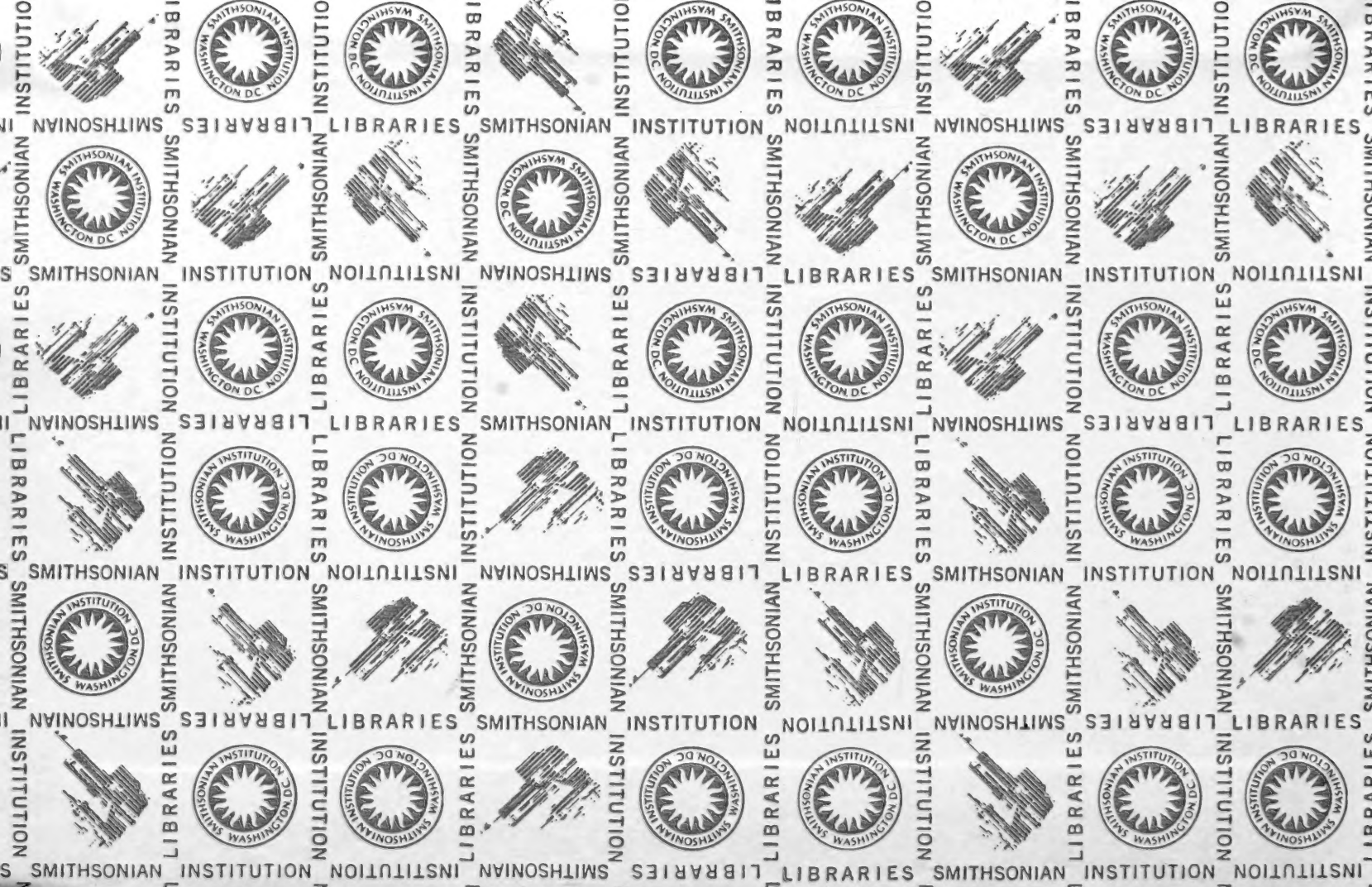
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A DESCRIPTIVE CATALOGUE

OF THE

NAIADES, OR PEARLY FRESH-WATER MUSSELS

BY
CHARLES TORREY SIMPSON

PART I

UNIONIDÆ
TRUNCILLA — MARGARITANA

BRYANT WALKER
DETROIT, MICHIGAN
1914

THE ANN ARBOR PRESS
ANN ARBOR

INTRODUCTION.

This work was begun immediately after the publication of my "Synopsis of the Naiades" in 1900 and was completed, substantially as it now appears, in the latter part of 1901. It was prepared in anticipation of an immediate publication with illustrations of all the species. But owing to the failure of that expectation and my removal to Florida in 1902, the MSS. was laid aside and nothing further done upon it until recently.

There can be no doubt but that the lack of a convenient handbook of the *Unionidæ*, which would enable the student to have adequate descriptions of all the species before him, has had much to do with the comparative neglect that the family has suffered, especially in this country, where it is so remarkably and characteristically developed. The literature is scattered, expensive, largely out of print and in many cases practically unattainable. The necessary consequence has been that the identification of nearly all of the rarer species has been based upon the individual conceptions of the more prominent collectors rather than on a careful study of the original descriptions. The resulting uncertainty and misapprehension as to the correct understanding of many of the species is widely prevalent among collectors and, even in the museums, there is not a little incorrectly named material.

It is with the hope of supplying, to some extent at least, this deficiency that it has been deemed advisable to publish this work in its present form, without illustrations.

What we should have in this country is a fully illustrated manual of the *Naiades* such as has been published on the land and fresh-water univalves. But, unfortunately, there seems to be no prospect of a publication of this kind and, in its absence, it has been thought that the gathering together of descriptions of all the species in a single volume would be of service to those already interested in our native species and might tend to excite a greater interest among those, who might be inclined to collect and study them, but who have been deterred by the lack of accessible literature. If this result shall be attained,

the purpose of this publication will have been fully accomplished.

While there is no doubt but that the increase of our general knowledge of the anatomy and embryology of the family will lead to and necessitate many changes in the arrangement proposed in the Synopsis, a large part of the more recent work that has been done is still in a tentative and formative condition and will be subject to more or less modification in the future, and many important groups still await the comprehensive examination that will be required to definitely determine their systematic position. As this work is intended to be a companion volume to the Synopsis and is especially intended to facilitate the study of the *species,* it has been deemed best to retain the systematic portion substantially as given in that work.

In order to bring the subject down to date, I have inserted in their proper places the original descriptions of all the North American species that have been published since the Synopsis appeared and also those of such foreign species as have been brought to my attention. But my long continued residence in the south, away from the large museums and without library facilities, has prevented me from expressing any personal opinion as to their validity and they are published without critical examination and simply for what they may be worth. As far as possible I have inserted them in what appears to be their proper systematic position, but in far too many cases, the reprehensible habit of many authors of describing supposed new species without any comparative remarks as to their relation to those already described and of ignoring all the recent advances in classification has compelled their reference to the class—*"incertæ sedis."*

I have not attempted to include the perennial vagaries of the Continental conchologists in dealing with the European fauna. I have already had occasion to express my opinion of their work in the Synopsis and have seen no reason to change it.

Since the publication of the Synopsis, it appears to have been demonstrated that in the genus *Parreysia* the embryos

are contained in all four of the *branchiæ,* and this would place this genus in the group I have called "*Tetrageneæ.*" The characters of the shells of *Parreysia* would indicate that they should be placed in *Rosanoramphus* as they have mostly zigzag radial beak sculpture. It is quite probable that this and some other genera may be connecting links between the two great groups.

Gravid material of two South African species has been examined by the author since writing the Synopsis. These and allied species had been placed provisionally in *Nodularia,* but they seem to be true Unios. None of the South African shells of this group that I had examined were in condition to show the beak sculpture.

The attempt to systematically classify much of the Asiatic and South African material and some of that of South America was largely tentative and it is quite likely that many changes will have to be made when more and better conchological and anatomical material can be carefully studied. When we are able to examine gravid material of all the larger groups, then and not till then will it be possible to be certain of the relationship of a large number of forms.

The only guide to classification in a great many cases was the shell, and such material as was accessible was often in bad condition or totally insufficient in quantity and the beaks in nineteen cases out of twenty were so eroded that it was impossible to determine anything accurately from them. In other cases only a figure and a description were accessible and in still others only a description. The character of dimorphism is a very important one, but to be of much use to the student, he should possess male and female shells of species, which are so developed. For example, in the genus *Nephronaias* many of the male shells cannot be distinguished from the shells of Unios by any means I know of, but the female shells of such species differ from the males in possessing a marsupial swelling, while those of *Unio* do not have it.

The following table taken from the Synopsis will show the classification of the genera and higher groups.

Family Unionidæ. Hinge with schizodont teeth; embryo a *glochidium*.

Subfamily Unioninæ. Beak sculpture more or less concentric; embryos in outer or all four of the gills. (*Exobranchiæ.*)

Ovisacs not separated by a sulcus.

Male and female shells alike.

(*Homogeneæ.*)

Marsupium filling the entire outer gills and forming smooth pads.

- *Anodonta* Bruguiere.
- *Colletopterum* Bourguignat.
- *Gabillotia* Servain.
- *Leguminaia* Conrad.
- *Lastena* Rafinesque.
- *Solenaia* Conrad.
- *Gonidea* Conrad.
- *Anodontoides* Simpson.
- *Strophitus* Rafinesque.
- *Pegias* Simpson.
- *Arcidens* Simpson.
- *Arkansia* Ortmann and Walker.
- *Symphynota* Lea.
- *Alasmidonta* Say.
- *Margaritana* Schumacher.
- *Unio* Retzius.
- *Pleurobema* Rafinesque.

(*Tetrageneæ.*)

Marsupium filling all four gills, forming smooth pads; beak cavities deep.

- *Quadrula* Rafinesque.
- *Schistodesmus* Simpson.
- *Gibbosula* Simpson.
- *Cuneopsis* Simpson.

Ovisacs distinctly marked out by a sulcus.

Male and female shells different.

(*Heterogeneæ.*)

Female shell inflated at base in front of posterior ridge; marsupium in hinder part of outer gills.

- *Truncilla* Rafinesque.
- *Micromya* Agassiz.
- *Lampsilis* Rafinesque.
- *Friersonia* Ortmann.
- *Pseudospatha* Simpson.
- *Hyriopsis* Conrad.
- *Chamberlainia* Simpson.
- *Simpsonia* Rochebrune.
- *Cristaria* Schumacher.
- *Lepidodesma* Simpson.
- *Pilsbryoconcha* Simpson.
- *Medionidus* Simpson.
- *Nephronaias* Crosse and Fischer.
- *Glebula* Conrad.
- *Obovaria* Rafinesque.
- *Plagiola* Rafinesque.

(*Digeneæ.*)

Female shell inflated behind, above posterior ridge.

- *Tritogonia* Agassiz.
- *Hemilastena* Agassiz.

Male and female shells alike.

(*Mesogeneæ.*)

Marsupium a few ovisacs in the center of outer gills.

- *Cyprogenia* Agassiz.
- *Obliquaria* Rafinesque.

(*Ptychogeneæ.*)

Marsupium occupying the whole outer gills in a series of folds.

- *Ptychobranchus* Simpson.

(*Eschatigeneæ.*)

Marsupium occupying the outer border of outer gills.

- *Dromus* Simpson.

(*Diageneæ.*)

Ovisacs filling the outer gills, running crosswise.

- *Strophitus* Rafinesque.

Family Unionidæ. Hinge with schizodont teeth; embryo a *glochidium*.

Subfamily Hyrianæ. Beak sculpture radial, male and female shells alike; marsupium filling the inner gills. (*Endobranchiæ*.)

(*Rosanorhamphus*.)

Beak sculpture generally zigzag-radial; epidermis often bright.

- *Nodularia* Conrad.
- *Harmandia* Rochebrune.
- *Grandidieria* Bourguignat.
- *Physunio* Simpson.
- *Simpsonella* Cockerell.
- *Pressidens* Haas.
- *Pseudodon* Gould.
- *Parreysia* Conrad.
- *Ptychorhynchus* Simpson.
- *Virgus* Simpson.
- *Cristadens* Simpson.
- *Rectidens* Simpson.
- *Lamellidens* Simpson.
- *Trapezoideus* Simpson.
- *Arconaia* Conrad.
- *Pseudavicula* Simpson.
- *Arcidopsis* Simpson.

(*Lamphorhamphus*.)

Beak sculpture radial, often curved; shell dull colored.

- *Tetraplodon* Spix.
- *Castalina* von Ihering.
- *Castaliella* Simpson.
- *Callonaia* Simpson.
- *Hyria* Lamarck.
- *Prisodon* Schumacher.
- *Diplodon* Spix.

Family Mutelidæ.

Hinge teeth taxodont; male and female shells alike; embryo a *lasidium*.

- *Spatha* Lea.
- *Mutela* Scopoli.
- *Chëlidonopsis* Ancey.
- *Brazzæa* Bourguignat.
- *Arthropteron* Rochebrune.
- *Pleiodon* Conrad.
- *Monocondylæa* d'Orbigny.
- *Iheringella* Pilsbry.
- *Fossula* Lea.
- *Leila* Gray.
- *Anodontitis Bruguiere*.
- *Mycetopoda* d'Orbigny.

I have endeavored to give fairly full descriptions of all the shell characters where they are of any importance and to describe the different features of the female shells of dimorphic species. Comparisons have been made between closely related species or those which resemble each other.

In a few cases changes have been made, as it has been possible to examine gravid material since the writing of the Synopsis, which proved that the position assigned to these forms was erroneous.

The subject is brought down to January 1, 1913. But I have included references to the new genera described by Dr. Haas in January, which had been illustrated prior to that time in the new edition of the Conchylien Cabinet.

CHARLES TORREY SIMPSON.

Little River, Florida.
February 1, 1913.

CONTENTS

DESCRIPTIVE CATALOGUE OF THE NAIADES

I.

Family UNIONIDÆ.

Shell nacreous, with a thick epidermis; beaks usually sculptured, often showing the remains of the nuclear shell; ligament opisthodetic; hinge with or without teeth, though with vestiges of them in every genus; when present schizodont and arranged as pseudocardinals and laterals; pallial line usually simple; prismatic border ordinarily narrow.

Animal with labial palpi almost always wider than long; anal opening usually separated from the superanal; embryo a glochidium, the soft parts being inclosed in a bivalve shell and borne in the inner or outer or all four leaves of the branchiæ.

Subfamily UNIONINÆ Swainson, 1840.

(EXOBRANCHIÆ.)

Shell having essentially concentric beak sculpture.

Animal with labial palpi somewhat drawn out, projecting posteriorly; embryos borne in the outer or in all four gills.

HETEROGENÆ.

Male and female shells different, the latter inflated in the post-basal region; beak sculpture decidedly doubly looped; embryos contained in ovisacs separated by a sulcus and occupying the hinder part of the outer gills.

Genus TRUNCILLA Rafinesque, 1819.

Truncilla Rafinesque, J. de Phys., Chimie, Hist. Nat., LXXXVIII, 1819, p. 427.

Shell rounded or oval, solid, inflated, generally smooth and rayed; with delicate beak sculpture, which has a tendency to be doubly looped; that of the female having a very decided inflation in the post-basal region, which is thinner than the rest of the shell, of different texture, often toothed, and usually radiately sculptured; laterals double in each valve, the inner in the right valve smaller. Animal generally having the inner gill united to the abdominal sac; female with a heavy flap of the mantle, which fills the post-basal swelling of the shell, and which has an inner ridge inside at some distance above the edge; marsupium very distinct, occupying the swollen part of the shell.

Type: *Truncilla triquetra* Rafinesque.

The species which I have placed in the generic group *Truncilla* though quite devious in form appear to be all rather closely related and to have characters in common, which separate them from all other Naiades. These characters show them to be easily the most highly organized and specialized of all the Unionidæ. The most striking character of the group is the remarkable difference between the shells of the males and females. This difference consists principally in the unusual development of what I have called the marsupial swelling of the latter, a character totally wanting in the shells of the males. This is always thinner than the rest of the shell, it is very commonly of somewhat different texture, it is inflated on the disk and usually at the base or posterior base, often into a widely rounded wing. In many cases it is marked off from the rest of the shell by sulci in front or behind or both. It is in nearly all cases more or less radially sculptured and toothed at the edge and the remains of these teeth are seen along the growth lines. The shells of male and female are alike at first and as a rule continue so until they are from a

third to half grown when the peculiar development of the marsupial swelling commences. They become so diverse when adult that it is little wonder that they have in several cases received different names at the hands of expert students. As a corresponding character in the animal of the female the marsupium, which occupies the hinder part of the outer gills, is very distinctly marked off from the rest of the branchiæ and is much produced, often resembling a kidney in front, and attached to the gill by a narrow band. The mantle is produced into a flap immediately over the marsupium, is often thickened at its border and has a strong, projecting flap within and back from the edge of the outer one.

Key to species of Truncilla.

As the male and female shells differ so greatly in most of the species I have thought it best to give keys for each.

FEMALE SHELLS.

Marsupial swelling large, inflated, rounded, placed at or a little behind the middle of the base.

Shell large, marsupial swelling much developed.

T. foliata; lewisii.

Shell and marsupial swelling of moderate size.

T. stewardsoni.

Marsupial swelling inflated, extending to near, but not quite to the posterior end of the base.

Shell much inflated, suborbicular or short elliptical, chestnut or brownish, shining, sculptured behind.

T. haysiana.

Pale yellow, somewhat elliptical, scarcely sculptured behind.

T. othcaloogensis.

Shell long, quadrate.

Greenish, rayed, silky. *T. sulcata; personata.*

Yellowish or brownish, not silky, or but slightly so.

T. brevidens; lenior; compacta; metastriata.

Marsupial swelling inflated, radially sculptured, extending to the extreme posterior base.

Raised into a sharp ridge, ending in a sharp point behind, shell triangular. *T. triquetra.*

Not sharply elevated nor sharp behind.

Much flattened below. *T. arcæformis.*

Projecting below the base. *T. penita.*

Marsupial swelling thin, compressed or subcompressed, rounded into a post-basal flap.

Swelling enormously produced, dark. *T. perplexa.*

Swelling moderate in size.

Usually dark. *T. propinqua; capsæformis.*

Rarely dark.

T. rangiana; biemarginata; deviata; sampsonii.

MALE SHELLS.

Shell triangular.

Without a radial depression.

Much inflated; posterior ridge high. *T. triquetra.*

Moderately inflated; posterior ridge not high.

T. compacta; modicella; penita; metastriata.

With a radial depression in front of the posterior ridge. *T. sampsonii.*

Very short.

Chestnut-colored, glossy, radially sculptured behind. *T. haysiana.*

Yellow-green, rayed, not sculptured behind. *T. personata.*

Long triangular. *T. propinqua.*

Shell subquadrate or subrhomboid.

Without a radial depression.

Posterior ridge high, sharp. *T. arcæformis.*

Posterior ridge rounded, sides flattened. *T. brevidens.*

With a radial depression.

Depression wide, distinct, deep. *T. foliata; lewisii.*

Depression moderate, not deep. *T. stewardsoni.*

Shell subtrapezoid, obliquely truncate below the posterior ridge, base line shorter than dorsal line.

Radial depression narrow; beaks far in front. *T. sulcata.*

Radial depression wide; beaks not at front end. *T. sampsonii.*

Shell irregularly elliptical or oval.

With a median row of knobs. *T. perplexa.*

Without knobs.

Subsolid. *T. capsæformis.*

Solid. With a strong biangulate posterior ridge. *T. florentina; biemarginata.*

Subgenus TRUNCILLA s. s.

Shell covered with broken rays, somewhat triangular, and without a wide, radiate, posterior furrow.

Group of *Truncilla triquetra.*

Shell greatly inflated, sharply truncate posteriorly; inflation of the female shell at extreme post-basal point.

TRUNCILLA TRIQUETRA Rafinesque.

Shell long triangular, much inflated, solid, slightly inequilateral; beaks full and high, turned inward and forward over a well-marked lunule; surface with irregular growth lines, the dorsal slope being radially sculptured; posterior ridge high, angled; epidermis tawny to yellow-green with broken, bright green rays and rows of green mottlings; teeth subcompressed; pseudocardinals ragged, there being usually two in each valve; laterals short, elevated, granular, two in the left valve and one in the right; beak cavities deep; anterior scars deep; nacre white, silvery, thicker in front. Male shell much larger than that of the female, less sharply triangular. Female shell having the marsupial region elevated into a narrowly rounded, radially sculptured ridge, projecting but little below the base.

Length (male) 69, height 48.5, diam. 35 mm.

Length (male) 55, height 36, diam. 31 mm.

Length (female) 52, height 34, diam. 39 mm.

Length (female) 45, height 28, diam. 30 mm.

Ohio River drainage; western New York to southern Michigan; Iowa; eastern Nebraska to Indian Territory.

Type locality, Falls of the Ohio.

Truncilla triqueter RAFINESQUE, Ann. Gen. Sci. Phys. Brux., XIII, 1820, p. 300, pl. LXXXI, figs. 1-4.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 15, pl. II, fig. 1.

Unio triqueter SHORT and EATON, Transylvania Jl., 1831, p. 79.

Truncilla triquetra SIMPSON, Syn., 1900, p. 517.

Unio triangularis BARNES, Am. Jl. Sci., VI, 1823, p. 272, pl. XIII, fig. 17.—HILDRETH, Am. Jl. Sci., X, 1828, p. 287, fig. —SAY, Am. Conch., No. 1, 1830, pl. IV.—REEVE, Conch. Syst., I, 1841, p. 118, pl. LXXXIX, fig. 9.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 10, pl. 1, figs. 4, 4*b*; Man., II, 1859, p. 137, fig. 662.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXVII, fig. 340.

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

Margarita (Unio) triangularis LEA, Syn., 1836, p. 18; 1838, p. 16.

Margaron (Unio) triangularis LEA, Syn., 1852, p. 23; 1870, p. 36.

Unio cuneatus SWAINSON, Phil. Mag., 1823, p. 112.

Unio formosus LEA, Trans. Am. Phil. Soc., IV, 1834, p. 111, pl. XVI, fig. 41; Obs. I, 1834, p. 121, pl. XVI, fig. 41.—CHENU, Ill. Conch., 1858, pl. VIII, figs. 12, 12*a*, 12*b*; Man., 1859, II, p. 138, fig. 664.

It will be observed from the above measurements that the female shell is much smaller than that of the male and that it is more inflated in proportion to height. It is more strongly and sharply truncate posteriorly, and is less high in proportion to length than that of the male. The marsupial swelling is but slightly developed, but it shows radial sculpture to its front edge. The beak sculpture of this species is very faint,

consisting of broken, somewhat doubly-looped ridges. The edges of the shell at the marsupial region are sometimes toothed and gape slightly.

Group of *Truncilla brevidens.*

Shell somewhat quadrate, not sharply truncate behind; post-basal swelling of female in front of post-basal point and rounded below.

TRUNCILLA BREVIDENS (Lea.)

Shell subquadrangular or subrhomboid, very solid, inflated when old, somewhat inequilateral; beaks much elevated, the umbonal region being elongated and flattened, the sculpture feeble, doubly-looped bars; posterior ridge well developed, narrowly rounded; surface with irregular growth lines with light radial sculpture behind; epidermis yellowish, tawny or tawny-brown with narrow, broken, radial markings, somewhat cloth-like; pseudocardinals ragged, generally double in each valve; laterals very short, heavy, strongly obliquely sculptured, double in the left valve and single or semi-double in the right; anterior scars small, deep; posterior scars large, deep; nacre white, silvery; beak cavities shallow. Male shell rhomboid or subtriangular in outline, moderately inflated, flattened on the disk. Female shell subquadrate, rounded behind, greatly inflated; marsupial swelling narrow, elevated, rounded, ridged, toothed below and marked with the remains of former teeth, separated decidedly from the rest of the shell, thinner and showing its position within by a rounded radial furrow; posterior muscle scars large, enormously deep.

Length (male) 83, height 63, diam. 42 mm.

Length (female) 73, height 55, diam. 50 mm.

Tennessee drainage.

Type locality, Ohio.

Unio brevidens LEA, Trans. Am. Phil. Soc., IV, 1834, p. 75, pl. VI, fig. 6; Obs., I, 1834, p. 85, pl. VI, fig. 6.—HANLEY, Biv. Shells, 1843, p. 198, pl. XX, fig. 41.—CHENU, Ill. Conch., 1858, pl. VIII, figs. 6, 6*a*, 6*b*.

Margarita (Unio) brevidens LEA, Syn., 1836, p. 29; 1838, p. 21.
Margaron (Unio) brevidens LEA, Syn., 1852, p. 32; 1870, p. 50.
Truncilla brevidens SIMPSON Syn., 1900, p. 517.
Unio interruptus CONRAD, New F. W. Shells, 1834, p. 69; Monog., X, 1838, p. 88, pl. XLVIII.—KUSTER, Conch. Cab. Unio, 1861, p. 182, pl. LVII, fig. 3; pl. LX, fig. 2.—REEVE, Conch. Icon., XVI, 1864, pl. XIV, fig. 56.

A large ponderous species having, when unworn, a more cloth-like surface than *T. triquetra*. The female shell is more quadrate than that of the male; it is more inflated and from the material I have been able to examine should judge that it is usually a little smaller. Most specimens are smaller than those whose measurements I have given, which are from the Lea collection. Until the male shell is nearly full grown it is scarcely inflated. The marsupial area of the female is very distinctly marked off from the rest of the shell by sulci, and its outline on the base of the shell is semicircular. It projects well below the rest of the base.

TRUNCILLA PENITA (Conrad.)

Shell solid, rhomboid or subtriangular, somewhat inequilateral; beaks full, elevated; surface with irregular growth lines, the posterior end being radially sculptured; epidermis yellowish, greenish-yellow or tawny, sometimes with inconspicuous dots or arrow-head markings of darker color arranged radially on the posterior part; pseudocardinals ragged, irregular, two in the left valve and three usually in the right; laterals short, double in the left valve, partly double in the right; beak cavities shallow; muscle scars impressed, the posterior ones in the female shell large and deep; nacre white or straw-color. Male shell much larger than that of the female, higher in proportion to length, more inflated, subtriangular. Female shell long rhomboid, smaller and less solid than that of the male; marsupial swelling rather large, radially grooved, projecting back behind the rest of the shell and below the base line, thinner and excavated within.

Length (male) 55, height 43, diam. 31 mm.

Length (female) 48, height 30, diam. 22 mm.

Lower Alabama and Tombigbee River drainage.

Type locality, Alabama River at Claiborne.

Unio penitus CONRAD, New F. W. Shells, 1834, pp. 33, 70, pl. v, fig. 1.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 18, pl. III, fig. 9.—REEVE, Conch. Icon., XVI, 1864, pl. XIV, fig. 55.

Margarita (Unio)penitus LEA, Syn., 1836, p. 19; 1838, p. 16.

Margaron (Unio) penitus LEA, Syn., 1852, p. 24; 1870, p. 36.

Truncilla penita SIMPSON, Syn., 1900, p. 518.

TRUNCILLA COMPACTA (Lea).

Shell subtriangular, somewhat inflated, solid, inequilateral; beaks full and high; surface with inconspicuous growth lines, the posterior end being lightly radially striate; epidermis slightly yellowish-green with a few faint, broken, darker rays; pseudocardinals ragged, double in the left valve, often treble in the right; laterals short, double in the left valve, scarcely double in the right; muscle scars impressed; nacre white. Male shell subtriangular, generally having the greatest diameter at the well-developed, narrowly rounded posterior ridge. Female shell subrhomboid or subtriangular, the marsupial swelling but slightly raised, not very strongly radially ridged or toothed, thin and somewhat excavated within, with large deep, posterior scars.

Length (male) 44, height 36, diam. 22 mm.

Length (female) 37, height 25, diam. 20 mm.

Alabama and Tombigbee drainage.

Type locality, Etowah and Connasauga Rivers, Ga.

Unio compactus LEA, Proc. Ac. Nat. Sci. Phila., III, 1859, p. 154; Jl. Ac. Nat. Sci. Phila., IV, 1859, p. 218, pl. XXVIII, fig. 98; Obs. VII, 1859, p. 36, pl. XXVIII, fig. 98.

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

Truncilla penita, (part), SIMPSON, Syn., 1900, p. 518.

The female shells of this species, so far as I have observed, are generally, though not always, shorter than those of *T.*

penita, they are rather narrower and more compressed in front. The posterior end is somewhat evenly rounded instead of being obliquely truncate, so that the marsupium does not extend quite as far back as the hinder part of the shell on the meridian line, or at least no farther. I am inclined to believe that the male shell is generally somewhat wedge-shaped when viewed from above, being most inflated at the posterior ridge.

TRUNCILLA METASTRIATA (Conrad).

Shell moderately solid, subinflated, elliptic-triangular to subquadrate, slightly inequilateral, beaks moderately full; surface delicately concentrically striate, radially striate behind; epidermis smooth, shining, yellowish or greenish-yellow with numerous faint, narrow, green rays; pseudocardinals subcompressed, rough; laterals short; nacre whitish or bluish-white. Male shell elliptic-triangular, slightly striate behind. Female shell somewhat quadrate, narrower in front, with a rounded posterior end; marsupial swelling full, not placed at the extreme posterior part of the shell, strongly sculptured.

Length (male) 31, height 23 mm.

Length (female) 28, height 20, diam. 15 mm.

Black Warrior River and Woodville, Alabama.

Type locality, Black Warrior River at Blount Springs, Ala.

Unio metastriatus CONRAD, Mon., XII, 1840, p. 104, pl. LVII, fig. 2.

Truncilla metastriata SIMPSON, Syn., 1900, p. 519.

I am much in doubt as to the validity of this species as it is very likely nothing more than a variety of *T. compacta*. A female shell before me is more delicate than females of that species, more polished and is finely rayed throughout.

TRUNCILLA MODICELLA (Lea).

Shell small, inflated, solid, subtriangular or subrhomboid, inequilateral; beaks apparently full and elevated; surface almost smooth; epidermis greenish-yellow to greenish-brown, scarcely shining; teeth somewhat roughened; laterals short, double in the left valve, semi-double in the right; beak cavi-

ties shallow; nacre flesh-color, inclining to reddish behind. Male shell with a well-developed posterior ridge, which is narrowly rounded, generally subtriangular in outline; female shell subquadrate, the marsupial area slightly raised and produced at the base, feebly radially striate.

Length (male) 25.5, height 19, diam 15 mm.

Length (young female) 19, height 14, diam. 9.5 mm.

Type locality, Connasaugua and Chattanooga Rivers, northwest Georgia.

Unio modicellus LEA, Pr. Ac. Nat. Sci. Phila., III, 1859, p. 171; Jl. Ac. Nat. Sci. Phila., IV, 1860, p. 347, pl. LVII, fig. 172; Obs., VIII, 1860, p. 29, pl. LVII, fig. 172.

Margaron (Unio) modicellus LEA, Syn., 1870, p. 41.

Truncilla modicella SIMPSON, Syn., 1900, p. 518.

A small species, the male shells of which look as though they might be a *Pleurobema* of the *rubellum* group. The female shell shows it to be a *Truncilla* of the *brevidens* group. It is smaller than any of the other species, dull colored, and, so far as I have seen, is rayless.

TRUNCILLA LENIOR (Lea).

Shell scarcely subsolid, somewhat inequilateral, subinflated to inflated, with delicate growth lines; beaks but little elevated, sculptured with irregular, doubly-looped bars; epidermis pale ashy-greenish or yellowish-green, with numerous narrow rays on the posterior half of the shell; pseudocardinals delicate, subcompressed, roughened; laterals short; nacre flesh-colored, brilliant. Female shell subquadrate, a little narrower in front; marsupial swelling well developed, marked off behind by a sulcus and with the hinder end of the shell radially sculptured and toothed, excavated within; posterior scars large, impressed.

Length (female) 25, height 16, diam. 13 mm.

Length (female) 24, height 15.5, diam. 10 mm.

Type locality, Stones River, Tennessee; also Paint Rock River, Woodville, Alabama.

Unio lenis LEA, Pr. Am. Phil. Soc., I, 1840, p. 286.

Unio lenior Lea, Tr. Am. Phil. Soc., VIII, 1843, p. 204, pl. XII, fig. 18; Obs., III, 1842, p. 42, pl. XII, fig. 18.—Chenu, Ill. Conch., 1858, pl. XXVII, figs. 4, 4*a*, 4*b*.—Reeve, Conch. Icon., XVI, 1864, pl. XVII, fig. 75.

Margaron (Unio) lenior Lea, Syn., 1852, p. 39; 1870, p. 62.

Truncilla lenior Simpson, Syn., 1900, p. 518.

I have only seen female shells of this species, which seems to be distinct from all others. Its delicate, almost thin, structure will at once distinguish it, as well as the decided sulcus behind separating the marsupial swelling from the rest of the shell. Unfortunately I have never seen a male shell.

Lea changed his name *lenis* to *lenior,* probably because Conrad had previously used the former for a species of *Unio,* which is no doubt a young *ventricosa.*

Group of *Truncilla arcæformis.*

Shell greatly inflated, with a sharp posterior ridge, and two lesser ridges above it; inflation of the female flattened on its base.

Truncilla arcæformis (Lea).

Shell usually subquadrate or subrhomboid in outline, very solid, greatly inflated, inequilateral; beaks very full and high, in contact with each other, their sculpture very faint; posterior ridge full and high, generally double, subangulate, behind which the shell is subtruncate; surface with irregular growth lines; epidermis tawny to yellowish-green, feebly rayed, more or less cloth-like; lunule small; pseudocardinals small, stumpy, rough, two in the left valve, one to three in the right; laterals short, elevated, often somewhat vertically striate; anterior scars small, deep; posterior scars shallow in the male shell, impressed in that of the female; nacre white, thickened in front. Male and female shells considerably alike in outline, those of the latter less elevated, having a high, rather wide marsupial swelling, which is flattened below and does not project below the base line and has radial, faint sculpture toothed

at the rest lines. It is thinner than the rest of the shell and much excavated within. Both male and female shells often have a shallow, radial furrow above the posterior ridge.

Length (male) 64, height 47, diam. 43 mm.

Length (female) 65, height 42, diam. 58 mm.

Length (female) 57, height 39, diam. 38 mm.

Length (female) 56, height 38, diam. 45 mm.

Tennessee and Cumberland River systems.

Type locality, Tennessee River.

Unio arcæformis LEA, Tr. Am. Phil. Soc., IV, 1831, p. 116, pl. XVII, fig. 44; Obs., I, 1834, p. 126, pl. XVII, fig. 44.—DESHAYES, Tr. Element. Conch., 1839, p. 18, pl. XXIX, fig. 6.—HANLEY, Biv. Shells, 1843, p. 182, pl. XXII, fig. 40.—DESHAYES, Traité Element. II. 1853. pl. XXIV, fig. 6.—CHENU, Ill. Conch., 1858, pl. XII, figs. 3, 3*a*, 3*b*.—REEVE, Conch. Icon., XVI, 1864, pl. XIV, fig. 57.

Margarita (Unio) arcæformis LEA, Syn., 1836, p. 18; 1838, p. 16.

Margaron (Unio) arcæformis LEA, Syn., 1852, p. 23; 1870, p. 36.

Truncilla arcæformis AGASSIZ, Arch. für Naturg., I, 1852, p. 44.—SIMPSON, Syn., 1900, p. 519.

Unio nexus SAY, Trans. Jl., IV, 1831, p. 527; Am. Conch., Pt. 6, 1834, pl. LI.—CONRAD, Monog., VIII, 1837, p. 68, pl. XXXVIII, fig. 1.—KUSTER, Conch. Cab. Unio, 1854, p. 69, pl. XVII, fig. 2.

This species is much inflated, very solid and generally rhomboid or subquadrate in outline. The female shell when old is more inflated than that of the male, the marsupial swellings are greatly developed towards its base, but on the base of the shell are flattened remarkably so that they do not project materially below the base line. The species does not seem to be very closely related to any other member of the genus. According to Binney, *Unio nexus* was first published in December, 1831, (Bib. N. Am. Conch., I, p. 266), and Scudder states that the fourth volume of the Transactions, containing Lea's description of *Unio arcæformis*, was published at the latter

end of 1831, and acknowledged by correspondents as received that year (Bib. of publications of Lea, 1885, p. 3). As I am not able to say which has precedence, I prefer retaining the well-known name of Lea rather than that of Say, which is less known.

Subgenus SCALENARIA (Rafinesque, 1820) Agassiz.

Scalenaria Rafinesque, Am. Gen. Sci. Phys. Brux., XIII, 1820, *p.* 309.—AGASSIZ, Arch. für Naturg., I, 1852, p. 43.

Male shell having a wide, radiating, shallow depression in front of the posterior ridge; that of the female having a small, rounded, well-defined, radial post-basal swelling. Animal with marsupium occupying the greater part of the outer branchiæ; mantle enlarged below; branchial opening with few papillæ.

Type: *Unio sulcatus* Lea.

Group of *Truncilla sulcata.*

Shell elliptical, beaks high and well forward; male shell not radiately striated posteriorly.

TRUNCILLA SULCATA (Lea).

Shell subquadrate or subtrapezoid, inflated, solid, very inequilateral; beaks somewhat elevated, prominent, their sculpture consisting of a few faint corrugations, which are sometimes broken or are occasionally doubly looped; lunule distinct, extending under the beaks; surface nearly smooth or irregularly concentrically sulcate; pseudocardinals subtriangular, elevated, ragged, two in the left valve, one to three in the right; laterals granulate, double in the left valve, partly double in the right; beak cavities rather shallow; muscle scars impressed; nacre purplish to deep purple, sometimes white. Male shell much larger than that of the female, usually somewhat trapezoid, the dorsal and basal lines lightly curved, the anterior end squarely subtruncate, the posterior end pointed bluntly above, slopingly truncate below, having a widely separated pair of posterior ridges, often with a radial sulcus between. Female shell subquadrate, the hinder end radially sculptured and

toothed throughout; marsupial swelling inflated, rounded, separated from the shell behind by a deep sulcation, strongly toothed, thinner and excavated within. Its hinder muscle scars are large and circular.

Length (male) 70, height 45, diam. 38 mm.

Length (female) 36, height 26, diam. 22 mm.

Ohio River drainage.

Type locality, Ohio.

Unio sulcatus LEA, Tr. Am. Phil. Soc., III, 1830, p. 430, pl. VIII, fig. 12.—SAY, Am. Conch., No. 1, 1830, pl. V.—LEA, Obs., I, 1834, p. 44, pl. VIII, fig. 12.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 11, pl. I, figs. 5, 5*a*; Conch., 1858, pl. XIII, figs. 3, 3*a*, 3*b*.—REEVE, Conch. Icon., XVI, 1864, pl. XIV, fig. 60.

Margarita (Unio) sulcatus LEA, Syn., 1836, p. 22; 1838, p. 18.

Margaron (Unio) sulcatus LEA, Syn., 1852, p. 26; 1870, p. 40.

Unio sulcata DESHAYES, An. sans Vert., 2d ed., VI, 1835, p. 548.

Truncilla sulcata SIMPSON, Syn., 1900, p. 520.

Unio ridibundus SAY, New Harm. Dis., II, 1829, p. 308; Am. Conch., I, 1830, pl. V.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 11, pl. I, fig. 6.—KUSTER, Conch. Cab. Unio, 1862, p. 276, pl. XCIII, fig. 2.—REEVE, Conch. Icon., XVI, 1864, pl. XV, fig. 63.

Unio obliquatus SAY, Am. Conch., VI, 1834.—KUSTER, Conch. Cab. Unio, 1862, p. 274, pl. XCII, fig. 3.

Unio gibbosus var. *perobliquus* CONRAD, Monog., VI, 1836, p. 50, pl. XXVII, fig. 2.

Unio perobliquus CONRAD, Cover of Monog., VIII, 1837.

Unio pectitus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 255; Jl. Ac. N. Sci. Phila., 1854, p. 297, pl. XXVII, fig. 4.

The above measurements, which are taken from two fully grown shells, show how much larger that of the male is. In the male shells the beaks usually project farther forward than they do in those of the female, in fact they often reach the extreme anterior end as in *Pleurobema decisum*. The surface of the shells, male and female, is usually yellowish-green with numerous rather fine but faint green, wavy rays when young

and in that state is often somewhat cloth-like. With age the shell usually becomes brownish and the rays are less conspicuous. The hinder part of the male shell is sometimes slightly radially sculptured.

Var. *delicata* Simpson.

Shell more delicate than the type, smaller, paler colored, that of the male (the only one I have seen) being somewhat drawn out and pointed behind.

Length (male) 44, height 31, diam. 24 mm.

Type locality, Detroit River, Michigan.

Truncilla sulcata var. *delicata* SIMPSON, Syn., 1900, p. 520.

Mr. Bryant Walker sent me specimens of a form, which I refer to this species, but which is smaller and in every way more delicate. I propose the above varietal name for it. It is no doubt derived from the typical *T. sulcata* but, owing to different environment, has changed considerably.

Group of *Truncilla haysiana.*

Shell shining, round-oval; posterior part of both male and female distinctly radially sculptured.

TRUNCILLA HAYSIANA (Lea).

Shell short, subtriangular to suborbicular, inflated, solid, inequilateral; lunule variable in size; beaks full and high, with feeble sculpture; surface with irregular, concentric sculpture, the anterior half of the shell rather smooth, the posterior half with radial, subnodulous sculpture, there being a shallow radial furrow in front of the posterior ridge; epidermis tawny to chestnut, shining on the front half of the shell, rough and often lighter colored behind; pseudocardinals stumpy, triangular, ragged, double in the left valve, partly double in the right; beak cavities shallow; muscle scars well impressed; nacre purple or white, male shell larger than that of the female, subtriangular. Female shell rather small, suborbicular; marsupial swelling raised but slightly, having a sharp ridge on its anterior part, thinner and somewhat excavated within; hinder muscle scars large and deep.

Tennessee and Cumberland River drainage.

Type locality, Cumberland River.

Unio haysianus LEA, Tr. Am. Phil. Soc., V, 1833, p. 35, pl. III, fig. 7; Obs. I, 1834, p. 147, pl. III, fig. 7.—KUSTER, Conch. Cab. Unio, 1856, p. 209, pl. LXIX, fig. 4.—REEVE, Conch. Icon., XVI, 1864, pl. XV, fig. 62.

Margarita (Unio) haysianus LEA, Syn., 1836, p. 22; 1838, p. 18.

Margaron (Unio) haysianus LEA, Syn. 1852, p. 26; 1870, p 41.

Scalenaria haysiana AGASSIZ, Arch. für Naturg., I, 1852, p. 48.

Truncilla haysiana SIMPSON, Syn., 1900, p. 520.

Unio sowerbyanus LEA, Tr. Am. Phil. Soc., V, 1839, p. 68, pl. X, fig. 28; Obs. I, 1834, p. 180, pl. X, fig. 28.—CONRAD, Monog., VIII, 1837, p. 66, pl. XXXVII, fig. 1.—KUSTER, Conch. Cab. Unio, 1852, p. 62, pl. XIV, fig. 3.—REEVE, Conch. Icon., XVI, 1864, pl. XIV, fig. 58.

Margarita (Unio) sowerbyanus LEA, Syn., 1836, p. 20; 1838, p. 17.

Margaron (Unio) sowerbyanus LEA, Syn., 1852, p. 25; 1870, p. 38.

The male and female shells of this differ a good deal as they do in nearly all the species of *Truncilla*. The male shell is subtriangular, as high or higher than it is long and the radial furrow in front of the posterior ridge is not very pronounced. Its posterior end shows vestiges of teeth along the growth lines but nothing like so distinctly as does the female shell, which is small, less high than long and suborbicular.

Lea described the female of this species as *Unio haysianus* and the male as *Unio sowerbyanus* in the same paper, the former having precedence.

TRUNCILLA OTHCALOOGENSIS (Lea).

Shell subquadrate, solid, inflated, inequilateral, nearly smooth with shining straw-colored epidermis, the hinder part with feeble radiating sculpture; hinge line a little arched; base nearly straight; anterior end rounded; posterior end almost squarely truncated above, rounded below; pseudocardinals elevated, subcompressed, ragged, two in each valve; lat-

erals short, double in the left valve, single in the right; nacre white; muscle scars well impressed. The only specimen seen, the type, is a female which has a scarcely swollen marsupial area, which is thinner than the rest of the shell and excavated within.

Length 22, height 16.5, diam. 13 mm.

Type locality, Othcalooga Creek, Gordon County, Georgia.

Unio othcaloogensis LEA, Proc. Acad. Nat. Sci. Phila. IX, 1857, p. 32; Jl. Ac. Nat. Sci. Phila., IV, 1858, p. 74, pl. XIV, fig. 54; Obs., VI, 1858, p. 74, pl. XIV, fig. 54.

Margaron (Unio) othcaloogensis LEA, Syn. 1870, p. 38.

Truncilla othcaloogensis SIMPSON, Syn., 1900, p. 521.

It is possible that this may be a young female of *T. haysiana*, but I do not think it is. All the females I have seen of that species have the marsupial area considerably more swollen than it is in this shell, it is differently shaped, being higher in front, and with the posterior end decidedly sculptured, while the sculpture on this specimen is scarcely visible. This shell has no radial furrow in front of the marsupial swelling, it is differently colored from *haysiana*, is more elongated and has a white nacre.

Subgenus DYSNOMIA Agassiz, 1852.

Dysnomia AGASSIZ, Arch. für Naturg., I, 1852, p. 43.

Shell of the male with a posterior and central radiating ridge, with a wide, flattened space between; that of the female with a greatly produced inflation, which is but little behind the center of the base and which is a continuation of the central ridge. Animal with the mantle beautifully maculate on its border; female animal unknown.

Type: *Unio foliatus* Hildreth.

TRUNCILLA FOLIATA (Hildreth).

Shell solid, but slightly inflated, subrhomboid or subquadrate, nearly equilateral; beaks somewhat elevated, subcompressed, elongated, with very faint, slightly corrugated sculpture; posterior ridge well developed, narrowly rounded, some-

what distinct from the rest of the shell; surface with uneven concentric sculpture; epidermis pale brownish-green or brownish, feebly rayed; pseudocardinals ragged, double in the left valve, single or treble in the right; laterals short, granular, more or less double in both valves; muscle scars impressed; nacre white; male shell subrhomboid, with a wide radial impression in front of the posterior ridge and a strong radial ridge in front of it; female shell with an enormously produced rounded wing-like marsupial swelling projecting downward and slightly backward at or a little behind the middle of the base.

Length (male) 65, height 54, diam. 34 mm.
Length (female) 66, height 48, diam. 45 mm.
Length (female) 63, height 65, diam. 32 mm.
Ohio River drainage.
Type locality, Ohio.

Unio foliatus HILDRETH, Am. Jl. Sci. XIV, 1828, p. 284, fig. 16.—CHENU, Man., 1859, II, p. 143, fig. 705.
Margarita (Unio) foliatus LEA, Syn. 1836, p. 13; 1838, p. 14.
Margaron (Unio) foliatus LEA, Syn. 1852, p. 20; 1870, p. 30.
Truncilla foliata SIMPSON, Syn., 1900, p. 521.
Unio flexuosus CONRAD, Monog., I, 1835, p. 8, pl. IV, fig. 2.—KUSTER, Couch. Cab. Unio. 1852, pp. 46, 211, pls. IX, fig. 2; LXX, fig. 1.—REEVE, Conch. Icon., XVI, 1864, pl. VI, fig. 22; XIII, fig. 53.
Dysnomia flexuosa AGASSIZ, Arch. für Naturg., I, 1852, p. 43.

One of the most remarkable Naiades in the world. The male and female shells are essentially alike until they are about one-third grown, the wide, radial furrow of the male being a very little deeper. At this period the female shell begins to develop a rounded, prolonged marsupial swelling almost at the middle of the base, which points slightly backward. This is sometimes 25 millimeters long and the same in width. It is scarcely, if at all, radially sculptured, but becomes thin and wing-like as it does in *T. perplexa* and gapes slightly. There is a more decided gape at the extreme posterior part of the shell. In the female shell the posterior scars are enlarged.

TRUNCILLA LEWISII Walker.

"Male shell quadrate, subcompressed; thick, solid; dark reddish-yellow, with faint, radiating lines of green; beaks laterally compressed, eroded, but apparently only slightly elevated above the hinge-line, sculpture not seen; anterior end regularly rounded, forming an obtuse angle at its junction with the basal emargination, which is nearly straight; dorsal line curved; posterior end slightly emarginate and terminating in a broad biangulation, which projects slightly beyond the posterior and basal lines; a broad, flat groove extends from the beaks to the basal emargination, widening and deepening as it approaches the base; posterior ridge prominent, rounded toward the beak, but becoming flattened and obsoletely biangulated as it approaches the posterior end; immediately in front of the median groove there is a strong anterior ridge, which becomes more pronounced as it approaches the base, where it terminates in an angle at the anterior end of the basal emargination, it is more or less roughened by the accentuation of the lines of growth, which elsewhere on the disk are not very strongly developed; dorsal slope concave behind the posterior ridge; interdentum rather long, narrow, rounded and parallel with the hinge; pseudocardinals in the left valve, two, the anterior very narrow, straight, directed obliquely forward and slightly widening toward the anterior end, the posterior triangular, the space between them triangular and extending to the hinge; in the right valve, two, the anterior smaller, but well developed, the posterior long, triangular, the space between them narrow, direct and extending to the hinge-line, the posterior tooth is separated from the interdentum by a deep groove; lateral teeth bent obliquely downward from the hinge-line, two in the left valve and one in the right, large and nearly straight; anterior adductor impressions large and deep, those of the protractor-pedis well marked, rather long and narrow, below and slightly behind the adductor; anterior retractor impressions small and on the base of the pseudocardinal; posterior adductor impressions large, semicircular; those of the posterior retractors small, but well impressed, above

that of the adductor and immediately below the end of the lateral tooth; cavity of the beaks shallow; nacre white.

The female shell is thinner than that of the male and proportionately wider, the posterior ridge being more oblique and more extended; the posterior line is straight or slightly curved, without the emargination noted in the male; the anterior ridge is greatly produced beyond the basal line in a triangular prolongation and this, the marsupial expansion, is of a different texture from the rest of the shell, being thin and dark green as in *T. capsæformis;* between this expansion and the posterior ridge, the base is deeply emarginate.

Length (male) 43, height 37, diam. 22.5 mm.

Length (female) 51, height 49.5, diam. 25 mm." (Walker.)

Type locality, Holston River, Tenn. Also, Clinch River and Holston River, Knox Co., Tenn., and Cumberland River, Port Burnside, Ky.

Truncilla lewisii WALKER, Naut. XXIV, 1910, p. 42, pl. III, figs. 3, 4, 5.

"This species, while closely related to *T. foliata* Hild., is clearly distinct. Besides being uniformly smaller, more delicate and smoother than *foliata,* it is specially characterized by the difference in the marsupial expansion, which is triangular and comparatively narrow at the extremity and of a different texture from the body of the shell. In *foliata,* this expansion is broadly rounded and is of the same texture as the remainder of the valve."

TRUNCILLA STEWARDSONI (Lea).

Shell irregularly rhomboid, solid, more or less inflated, subequilateral; beaks not greatly elevated, the umbonal region elongated and sometimes slightly compressed; posterior ridge well developed, narrowly rounded or biangulate, in front of which is a wide, shallow, radiating depression; epidermis greenish-yellow to brownish, feebly rayed; pseudocardinals small, ragged, generally double in each valve; laterals short, more or less double in both valves; muscle scars impressed; nacre white or straw-colored. Male shell varying from subtri-

angular to subrhomboid, usually biangulate at the termination of the posterior ridge, the radial depression deeper than in the female shell. Female shell not inflated, subrhomboid or subquadrate, with a wide, rounded marsupial swelling just behind the middle of the base.

Length (male) 59, height 47, diam. 35 mm.
Length (male) 48, height 40, diam. 24 mm.
Length (female) 41, height 39, diam. 19 mm.
Tennessee River.
Type locality, Chattanooga River, Tenn.

Unio stewardsoni LEA, Tr. Am. Phil. Soc., X, 1852, p. 278, pl. XXIII, fig. 36; Obs., V, 1852, p. 34, pl. XXIII, fig. 36.—REEVE, Conch. Icon., XVI, 1864, pl. XV, fig. 66.

Margaron (Unio) stewardsoni LEA, Syn. 1852, p. 20; 1870, p. 38.

Truncilla stewardsoni SIMPSON, Syn., 1900, p. 521.

Evidently very closely related to *T. foliata,* but a smaller species in which the peculiar characters are less exaggerated. The radial depression in the male shell is not so deep or distinct as it is in *foliata.* In the female shell it is quite feeble and runs into the marsupial swelling where it is generally obliterated, while in *foliata* it continues down to the base of the shell, behind the marsupial swelling.

Subgenus PILEA Simpson, 1900.

Pilea SIMPSON, Syn., 1900, p. 522.

Male shell with a wide, shallow, radiating depression in front of the posterior ridge, that of the female with a rounded, foliaceous swelling at the posterior base. Animal with the post-basal flap of mantle of female very heavy; ovisacs not extending to the top of marsupium.

Type: *Unio personatus* SAY.

Group of *Truncilla personata.*

Shell inflated, rather solid, nearly as high as long; female not having a central depression, post-basal swelling small.

TRUNCILLA PERSONATA (Say).

Shell solid, subtriangular or subquadrate, inflated, inequilateral, beaks full and high; posterior ridge only moderately developed; surface irregularly concentrically sculptured; epidermis greenish-yellow, brownish or greenish-brown in old shells, with faint wavy rays, often silky or cloth-like; pseudocardinals triangular, ragged, two in the left valve, one to three in the right; laterals short, usually double in each valve; muscle scars somewhat impressed; nacre white or flesh-colored, thinner behind. Male shell subtriangular; posterior ridge usually feebly double; in front of it is a wide radial depression. Female shell usually subquadrate; marsupial swelling occupying the place of the radial depression, slightly swollen, radially sculptured and toothed, thin and excavated within.

Length (male) 57, height 48, diam. 33 mm.

Length (male) 44, height 46, diam. 28 mm.

Length (female) 54, height 43, diam. 33 mm.

Length (female) 46, height 42, diam. 26 mm.

Ohio River drainage.

Type locality, Wabash River.

Unio personatus SAY, New Harm. Diss. II, No. 20, 1829, p. 309.—CONRAD, Monog., V, 1836, p. 47, pl. XXIV.—KUSTER, Conch. Cab. Unio, 1852, p. 48, pl. X, fig. 1.—REEVE, Conch. Icon., XVI, 1864, pl. XV, fig. 64.

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

Margaron (Unio) personatus LEA, Syn., 1852, p. 35; 1870, p. 38.

Scalenaria personata AGASSIZ, Arch. für Naturg., I, 1852, p. 43.

Truncilla personata SIMPSON, Syn., 1900, p. 522.

Unio pileus LEA, Trans. Am. Phil. Soc., IV, 1834, p. 119, pl. XVIII, fig. 47; Obs., I, 1834, p. 129, pl. XVIII, fig. 47.—CHENU, Ill. Conch., 1858, pl. XV, figs. 2, 2*a*, 2*b*.—REEVE, Conch. Icon., XVI, 1864, pl. XIV, fig. 59.

Margarita (Unio) pileus LEA, Syn. 1836, p. 20; 1838, p. 17.

Margaron (Unio) pileus LEA, Syn. 1852, p. 24.

Unio capillaris LEA, Trans. Am. Phil. Soc., V, 1834, p. 29, pl. II, fig. 2; Obs., I, 1834, p. 141, pl. II, fig. 2.

The male shell of this species resembles closely in form those of certain species of *Pleurobema* such as *P. edgarianum* or *P. dolabelloides*. The marsupial swelling of the female is rather small, it does not differ much in texture from the rest of the shell and is not separated from it by sulci, being merely a gradual inflation.

Group of *Truncilla perplexa*.

Shell of the male with median and posterior radiating ridges, both of which are usually somewhat nodose, post-basal expansion of the female rounded, large, thin, placed far back.

TRUNCILLA PERPLEXA (Lea).

Shell solid, subinflated, inequilateral, irregularly ovate, elliptical or obovate; beaks full, somewhat turned forward over a small lunule; surface with irregular growth lines, with a radial row of knobs running down near the middle of the disk and sometimes with others on the low, narrowly rounded posterior ridge; epidermis tawny or yellowish-green, feebly rayed, smooth and shining; pseudocardinals triangular, double in the left valve, triple in the right; muscle scars well impressed; nacre white to salmon red. Male shell generally irregularly ovate with a deep, rather wide radial groove behind the row of nodules or knobs, ending in a sinus, the hinder end bluntly pointed. Female shell generally obovate, larger than that of the male, having an enormous, flattened, rounded marsupial swelling extending from the middle of the base to near the upper part of the posterior end, this being thin and usually dark green; posterior muscle scars large, impressed.

Length (male) 50, height 37, diam. 28 mm.

Length (male) 58, height 41, diam. 26 mm.

Length (female) 87, height 57, diam. 36 mm.

Ohio River drainage; southern Michigan?

Type locality, Ohio River.

Unio perplexus LEA, Trans. Am. Phil. Soc., IV, 1831, p. 112, pl. XXVII, fig. 42; Obs., I, 1834, p. 122, pl. XVII, fig. 42.—HANLEY, Biv. Shells, 1843, p. 181, pl. XXII, fig. 39.—CHENU, Ill. Conch., 1858, pl. XVIII, figs. 5, 5*a*, 5*b*.

Margarita (Unio) perplexus LEA, Syn. 1836, p. 17; 1838, p. 16.

Margaron (Unio) perplexus LEA, Syn. 1852, p. 23; 1870, p. 34.

Truncilla perplexa SIMPSON, Syn., 1900, p. 522.

Unio gibbosus FERUSSAC, Guer. Mag., 1835, p. 27.—CONRAD, Monog., VI, 1836, p. 50, pl. XXVII, fig. 1.—REEVE, Conch. Icon., XVI, 1864, pl. XI, fig. 41, 41*a*, 41*b*.

Dysnomia gibbosa AGASSIZ, Arch. für Nat., I, 1852, p. 43.

Unio gibbosus, Raf. v. *perplexus* PETEL, Conch. Sam., III, 1890, p. 153.

Unio torulosus CONRAD, New F. W. Shells, 1834, p. 72.

Unio obliquus POTIEZ and MICHAUD, Gall. Moll., 1844, p. 153, pl. LVIII, figs. 3, 4.

Lea's species was published, according to Scudder (Bib. of Isaac Lea, p. 3), in the latter part of 1831. Rafinesque published a species, *"Truncilla, Unio, perplexus,"* in the Continuation of a Monograph in October, 1831, which I can not identify. I do not know which name appeared first, but I think it best to retain the well-known and properly described name of Dr. Lea.

In this species the female shell is considerably larger than that of the male and is produced below and behind into an enormous, rounded, compressed marsupial wing, which is rather thin and dark without and has a wide prismatic border. The row of knobs is very variable. Sometimes these knobs are ten millimeters long and much elevated, there being only two or three of them in the row. In the variety *cincinnatiensis* they are small and numerous while in the variety *rangiana* they are almost or even quite wanting.

Var. *rangiana* (Lea).

Shell more compressed than the type; knobs on the median radial ridge low or even wanting. The marsupial swelling of the female shell is not quite so pronounced as it is in the type.

Ohio River drainage and southern Michigan.

Type locality, Ohio River, Cincinnati, O.

Unio rangianus LEA, Trans. Am. Phil. Soc., VI, 1839, p. 95, pl. XVIII, fig. 56; Obs., II, 1838, p. 95, pl. XVIII, fig. 56.—HANLEY, Biv. Shells, 1843, p. 187, pl. XXI, fig. 48.—CHENU., Ill. Conch., 1858, pl. XXIV, figs. 5, 5*a*, 5*b*.—KUSTER, Conch. Cab. Unio, 1861, p. 257, pl. LXXXVII, fig. 1; LXXXIX, fig. 1. —REEVE, Conch. Icon., XVI, 1864, pl. XIV, fig. 54.

Margarita (Unio) rangianus LEA, Syn., 1838, p. 18.

Margaron (Unio) rangianus LEA, Syn., 1852, p. 26; 1870, p. 40.

Truncilla perplexa var. *rangiana* SIMPSON, Syn., 1900, p. 523.

Truncilla rangiana ORTMANN, Ann. Car. Mus., VIII, 1912, p. 358, fig. 28.

Unio gubernaculum REEVE, Conch. Icon., XVI, 1865, pl. XXVIII, fig. 146.

It is claimed by some excellent authorities that this form is specifically distinct from *perplexa*, but I have seen so much connecting material that I cannot satisfactorily separate the two.

Var. *cincinnatiensis* (Lea).

Shell having numerous small, somewhat sharp knobs on the radial ridge with sometimes a few on the posterior ridge and even an intermediate row in the furrow between the two; marsupial swelling of the female more inflated than in the type.

Type locality, Ohio River, Cincinnati, O.

Unio cincinnatiensis LEA, Proc. Am. Phil. Soc., I, 1840, p. 285; Tr. Am. Phil. Soc., VIII, 1842, p. 194, pl. VIII, fig. 4; Obs. III, 1842, p. 32, pl. VIII, fig. 4.—CHENU, Ill. Conch., 1858, pl. XXX, figs. 3, 3*a*, 3*b*.

Margaron (Unio) cincinnatiensis LEA, Syn., 1852, p. 22; 1870, p. 33.

Truncilla perplexa var. *cincinnatiensis* SIMPSON, Syn., 1900, p. 523.

Unio phillipsii REEVE, Conch. Icon., XVI, 1864, pl. IV, fig. 15.

The shells in the Lea collection are the only ones I have seen of this form, which are typical, though they show considerable variation and some of them approach the type.

TRUNCILLA SAMPSONII (Lea).

Shell solid, inflated, subquadrate or trapezoid, inequilateral with high full beaks, whose sculpture is feeble and corrugated; lunule wide but small; posterior ridge low, narrowly rounded, placed near the dorsal line; median ridge rounded, rarely showing vestiges of knobs; surface rather smooth, usually with a concentric constriction at the rest marks; epidermis straw-color or yellowish-green with numerous green rays, silky; teeth solid; pseudocardinals triangular, laterals double in each valve. Male shell not differing greatly in outline from that of the female. Female shell with the marsupial swelling but slightly produced, differing little in color or texture from the rest of the shell, sometimes having radial grooves. The nacre of male and female shells varies from bluish-white to salmon.

Length (male) 43, height 33, diam. 24 mm.

Length (female) 45, height 35, diam. 29 mm.

Wabash River; Tennessee?

Type locality, Wabash River, New Harmony, Ind.

Unio sampsonii LEA, Pr. Ac. N. Sci. Phila., VI, 1861, p. 392; Jl. Ac. N. Sci. Phila., V, 1862, p. 192, pl. XXV, fig. 261; Obs., IX, 1863, p. 14, pl. XXV, fig. 261.

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

Truncilla sampsonii SIMPSON, Syn., 1900, p. 523.

This seems to be a smaller species than *T. perplexa*, is generally more inflated, is almost entirely without anything like knobs and the shells of both male and female are subquadrate or trapezoid. The species does not seem to be common and it is possible that none of the specimens I have seen are fully adult.

TRUNCILLA PROPINQUA (Lea).

Shell subtriangular to subelliptical, inflated, solid, very inequilateral; beaks full and high; lunule wide; posterior ridge rather narrowly triangular; median ridge full; sometimes it

and the posterior ridge are slightly knobbed; between the two there is a wide, well-impressed radial furrow, which is deepest in the male shell; surface with decidedly sulcate rest marks; epidermis varying from straw-colored or tawny to yellow-green, feebly rayed, subshining or somewhat silky; pseudocardinals triangular; double in the left valve, single or treble in the right; laterals curved, strong, double in each valve; muscle scars small, impressed; nacre bluish-white to straw-color, rarely pink. Male shell subtriangular, the deep, radial depression ending in a rather narrow sinus below. Female shell subelliptical, the marsupial swelling rounded, moderately produced, often darker than the rest of the shell.

Length (male) 55, height 40, diam. 33 mm.
Length (male) 53, height 45, diam. 33 mm.
Length (female) 58, height 47, diam. 32 mm.
Length (female) 57, height 43, diam. 33 mm.
Tennessee and Cumberland River drainage.
Type locality, Florence and Tuscumbia, Ala.

Unio propinquus LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 83; Jl. Ac. N. Sci. Phila., V, 1862, p. 63, pl. v, fig. 212; Obs., VIII, 1862, p. 67, pl. v, fig. 212.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIX, fig. 417.

Margaron (Unio) propinquus LEA, Syn., 1870, p. 34.

Truncilla propinqua SIMPSON, Syn., 1900, p. 523.

Rather more solid and inflated than *T. perplexa,* with a deeper, narrower radial impression and having a much less developed marsupial swelling in the female shell. It is rather more in equilateral than *perplexa.*

TRUNCILLA BIEMARGINATA (Lea).

Shell subtriangular, subrhomboid or irregularly obovate, solid, but little inflated, inequilateral; beaks moderately full and elevated; posterior ridge decidedly biangulate; median ridge but moderately developed; the radial depression between the two wide and shallow; growth lines strong and irregular; epidermis yellowish-green, faintly rayed; pseudocardinals triangular, two in the left valve and three in the right; laterals double in the left valve, partly double in the right; nacre

bluish-white to creamy. Male shell with a decidedly biangulate posterior ridge ending in a biangulation below, the radial depression in front of it wide; female shell somewhat obovate, the radical depression fading out on the rounded, darkened marsupial swelling.

Length (male) 46, height 32, diam. 22 mm.

Length (female) 36, height 28, diam. 17 mm.

Tennessee River drainage.

Type locality, Florence, Ala.

Unio biemarginatus LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 83; Jl. Ac. N. Sci. Phila., VI, 1866, p. 47, pl. XVI, fig. 45; Obs., XI, 1867, p. 51, pl. XVI, fig. 45.

Margaron (Unio) biemarginatus LEA, Syn., 1870, p. 38.

Truncilla biemarginata SIMPSON, Syn., 1900, p. 524.

Smaller than *T. perplexa* or *T. propinqua*, having the posterior ridge more decidedly biangulate.

TRUNCILLA CAPSÆFORMIS (Lea).

Shell subsolid, elliptical or irregularly obovate, convex, somewhat inequilateral; beaks moderately full and elevated, their sculpture very feeble; surface with irregular growth lines; epidermis yellowish-green with green, rather faint rays; pseudocardinals small, subcompressed, double in each valve; laterals single in the right valve, double in the left; anterior scars small, impressed; posterior scars large, shallow; nacre bluish-white to creamy, thicker in front. Male shell almost evenly elliptical, often with a double posterior ridge and slightly biangulate behind. Female shell with an enormously developed, rounded, compressed marsupial swelling, which is occasionally toothed a little and is dark green in color and thin. It is frequently marked off from the rest of the shell by a sulcus in front and behind.

Length (male) 67, height 42, diam. 26 mm.

Length (female) 48, height 36, diam. 17 mm.

Length (female) 52, height 37, diam. 19 mm.

Tennessee River drainage.

Type locality, Cumberland River.

Unio capsæformis Lea, Tr. Am. Phil. Soc., VI, 1834, p. 31, pl. II, fig. 4;—Obs., I, p. 143, pl. II, fig. 4.—Conrad, Monog., VIII, 1837, p. 72, pl. XL, fig. 2, 3.—Hanley, Biv. Shells, 1843, p. 19, pl. XXI, fig. 5.—Kuster, Conch. Cab. Unio, 1852, p. 44, pl. VIII, fig. 5.—Reeve, Conch. Icon., XVI, 1864, pl. XVII, figs. 79, 79*a*, 79*b*.

Margarita (Unio) capsæformis Lea, Syn., 1836, p. 24; 1838, p. 19.

Margaron (Unio) capsæformis Lea, Syn., 1852, p. 27; 1870, p. 42.

Truncilla capsæformis Simpson, Syn., 1900, p. 524.

The above measurements of a male shell are from a rather large specimen. I have seen female shells considerably larger than the specimens whose measurements I have given, but they do not often grow larger. The species is less solid than most of the members of the group, the male shell being nearly evenly elliptical and that of the female having a greatly rounded, compressed marsupial swelling. It resembles the female of *T. perplexa*, but is smaller, thinner, is less rude and lacks knobs.

Truncilla florentina (Lea).

Shell irregularly elliptical or obovate, more or less inflated, inequilateral, rather solid; beaks quite full and elevated; surface with uneven growth lines; epidermis yellowish-green, feebly rayed; pseudocardinals small, triangular, double in each valve; laterals double in the left valve, single or partly double in the right; anterior scars small, impressed; posterior scars shallow; nacre bluish-white, thicker in front. Male shell irregularly elliptical, with a decidedly double posterior ridge, which ends in a biangulation behind, with a shallow radial depression in front of it, the ridge in front of this full; female shell with a somewhat produced, rounded, thin, compressed marsupial swelling, usually not darker than the rest of the shell, often toothed and marked off from the rest of the shell by sulci.

Length (male) 44, height 32, diam. 23 mm.

Length (female) 33, height 26, diam. 18 mm.

Tennessee River drainage. Cumberland River.

Type locality, Florence, Ala., and Cumberland River, Tenn.

Unio florentinus LEA, Pr. Ac. N. Sci. Phila., VII, 1857, p. 83; Jl. Ac. N. Sci. Phila., V, 1862, p. 64, pl. v, fig. 213; Obs., VIII, 1862, p. 68, pl. v, fig. 213.

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

Truncilla florentina SIMPSON, Syn., 1900, p. 524.

Unio turgidulus LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 40; Jl. Ac. N. Sci. Phila., V, 1862, p. 62, pl. v, fig. 211; Obs., VIII, 1862, p. 66, pl. v, fig. 211.—REEVE, Conch. Icon., XVI, 1864, pl. XVII, fig. 80.

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

Unio nux KUSTER, Conch. Cab. Unio, 1861, p. 218, pl. LXXIII, fig. 2.

Unio sacculus REEVE, Conch. Icon., XVI, 1864, pl. XV, fig. 67. —ANTHONY, Am. Jl. Conch., I, 1865, p. 157, pl. XII, fig. 3.

Unio saccatus KUSTER, Conch. Cab. 1861, p. 263, pl. LXXXIX, fig. 2.

So far as I have seen the female shell is smaller than that of the male. The male is more inflated than that of *T. biemarginata*, the angles of the posterior ridge are not quite so pronounced nor is the radial depression so deep. Lea's *Unio turgidulus* is the male and his *florentinus* the female of the same species.

TRUNCILLA DEVIATA (Reeve).

Shell rather solid, somewhat elongated, more or less inflated, inequilateral; beaks high and full; surface with irregular growth lines; epidermis yellowish-green with numerous, narrow, feeble rays; pseudocardinals small, rough, subcompressed, two in each valve; laterals single in the right valve and double in the left; anterior scars small, impressed; posterior scars shallow; nacre bluish-white, thinner and iridescent behind. Male shell elliptical or ovate, the posterior ridge scarcely biangulate. Female shell with high full beaks, narrowly rounded in front, with a large, rounded, subcompressed marsupial swelling, which extends considerably below the rest of the basal line and is often radially sculptured and grooved. It is sometimes darker than the rest of the shell.

Length (female) 39, height 24, diam. 20 mm.

Cumberland and Tennessee Rivers.

Type locality, Tennessee.

Unio deviatus REEVE, Conch. Icon., XVI, 1864, pl. xv, fig. 61. —ANTHONY, Am. Jl. Conch., I, 1865, p. 156, pl. xii, fig. 2.

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

Truncilla deviata SIMPSON, Syn., 1900, p. 524.

Probably distinct from *T. florentina*, though it may be but a variety of it. Reeve figured it in the Conchologia Iconica, but his specimen was not characteristic and he credited it to Anthony's manuscript in Museum Cuming. The next year, 1865, Anthony described it in the American Journal of Conchology and gave a characteristic figure of a female shell. The only male shell I have seen is in the Lea collection, 27 millimeters long, 19 high, and 13 in diameter, is no doubt young and has the beaks much eroded. The female shells are more elongated than those of *florentina*, have much fuller, higher beaks and the marsupial swelling is rather more produced. It has been found at Hardy, Arkansas, by Mr. J. H. Ferriss.

Unfigured and indeterminate species.

Truncilla (Unio) perplexus Rafinesque.

Truncilla granulatus Rafinesque.

Unio (*Truncilla*) *metaplata* Rafinesque.

All of these in Continuation of Monog., 1831, p. 4.

Genus MICROMYA (Agassiz, 1852) Simpson.

Micromya AGASSIZ, Arch. für Nat., 1852, p. 57.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 337.

Shell subtriangular oval, solid, dark, feebly rayed with undulating lines; beak sculpture almost wanting, consisting of a few feeble, doubly-looped ridges; hinge teeth heavy, laterals club-shaped and truncated posteriorly; post-basal swelling of the female distinct and often rather abrupt, sometimes somewhat irregularly radially ridged, the shell of this part being quite thin.

Animal with mantle fringed below, maculate on the border, which is greatly thickened at the post-basal part in the female and developed into a flap, with a distinct, toothed ridge inside; marsupium occupying the posterior part of the outer branchiæ in numerous distinctly marked ovisacs; inner gill free from abdominal sack in part.

Type: *Unio fabalis* Lea.

Ortmann, (l. c.), considers this a subgenus of *Eurynia*.

Group of *Micromya fabalis*.

Shell small, with faint, undulate rays, inflated area of female scarcely radiately striated.

MICROMYA FABALIS (Lea).

Shell small, long ovate or long elliptical, very solid, subinflated to inflated, inequilateral; beaks somewhat elevated, subcompressed, pointed, turned forward a little over a well-marked lunule, having doubly-looped, subnodulous sculpture; surface with irregular growth lines; epidermis ashy-greenish, wavily rayed with dirty brown or brownish-green; pseudocardinals triangular, low, solid, double in the left valve, single, double or treble in the right; laterals heavy, double in the left valve, often partly double in the right; muscle scars small, impressed; nacre white or bluish, iridescent behind, thicker in front. Male shell usually long ovate, subinflated or convex. Female shell generally long elliptical, inflated; the marsupial swelling but slightly inflated, not distinctly marked off from the rest of the shell, placed toward the hinder part of the base and occasionally having vestigial radial wrinkles, thinner than the rest of the shell, and excavated within.

Length (male) 38, height 22, diam. 12 mm.

Length (male) 30, height 18.5, diam. 14 mm.

Length (female) 25.5, height 15, diam. 12.5 mm.

Ohio River drainage; Rouge River, near Detroit; New York.

Type locality, Ohio River.

Unio fabalis LEA, Tr. Am. Phil. Soc. IV, 1831, p. 86, pl. x, fig. 16; Obs., I, 1834, p. 96, pl. x, fig. 16.—CHENU, Ill. Conch., 1858, pl. VIII, figs. 1, 1*a*, 1*b*.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVI, fig. 196.

Margarita (Unio) fabalis LEA, Syn. 1836, p. 28; 1838, p. 20.

Margaron (Unio) fabalis LEA, Syn., 1852, p. 31; 1870, p. 49.

Micromya fabalis SIMPSON, Syn., 1900, p. 525.

Eurynia (Micromya) fabalis ORTMANN, Ann. Car. Mus., VIII, 1912, p. 339.

Unio capillus SAY, Trans. Journ., IV, 1831, p. 528.

Unio lapillus SAY, Am. Conch., V, 1832, pl. XLI; VI, 1834, No. 49.—CONRAD, Monog., VI, 1836, p. 54, pl. XXIX, fig. 12.—CHENU, Bib. Conch., 1st ser. III, 1845, p. 52, pl. XIV, figs. 1, 1*a*, 1*b*.—KUSTER, Conch. Cab., 1848, p. 53, pl. XI, fig. 3.

A very variable species, in size, form and solidity. Some adult male shells are scarcely solid or inflated; others are ponderous and very full. Usually the female shell is smaller and more inflated than the male.

Group of *Micromya cælata.*

Shell triangular ovate, with a low, rounded posterior ridge; male and female shell distinctly wrinkled behind.

MICROMYA CÆLATA (Conrad).

Shell subtriangular to subovate, very solid, convex to inflated, inequilateral; beaks high, often subcompressed, turned forward over a small lunule, with feeble, subnodulous sculpture; posterior ridge well developed, narrowly rounded; surface with irregular growth lines and well-marked rest periods with strong, corrugated, subradial sculpture on the hinder half of the shell, which is divaricate on the posterior ridge and which sometimes covers the entire shell; epidermis clouded, dull green and yellowish-green, feebly rayed, rarely uniform dull green; pseudocardinals low, subradial, ragged, two in the left valve, one to three in the right valve; laterals heavy, double in the left valve, partly double in the right; muscle scars small, impressed; nacre white, silvery, iridescent behind, thicker in front. Male shell subovate or subtriangular,

with a broad, shallow, radial depression in front of the posterior ridge, or having the disk at least flattened. Female shell usually ovate, sometimes inflated, smaller than that of the male, with a feebly developed marsupial swelling on the base near the posterior end. This is rougher than the rest of the shell and shows the strong folds within.

Length (male) 51, height 35, diam. 21 mm.

Length (male) 42, height 33, diam. 17 mm.

Length (female) 37, height 25, diam. 20 mm.

Length (female) 34, height 25, diam. 14 mm.

Tennessee River drainage.

Type locality, Elk and Flint Rivers, Tenn.

Unio cælatus CONRAD, Am. Jl. Sci., XXV, 1834, p. 338, pl. 1, fig. 1; New F. W. Shells, 1834, p. 29, pl. III, fig. 4; p. 68.—CHENU, Bib. Conch., 1st ser. III, 1845, p. 16, pl. III, fig. 3.—REEVE, Conch. Icon., XVI, 1864, pl. II, fig. 7.

Margarita (Unio) cælatus LEA, Syn. 1836, p. 12; 1838, p. 14.

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

Micromya cælata SIMPSON, Syn., 1900, p. 525.

While the shells of this species differ somewhat from those of *M. fabalis*, it is more in degree than in diversified characters. The latter rarely exhibits even traces of corrugated sculpture, yet it is sometimes seen, especially on the marsupial swelling. *M. cælata* is generally much higher than *M. fabalis*, but there are specimens of the females of both species before me that are much alike in outline. Both species are colored much alike and the marsupial swelling, the heavy shell, wide hinge plate, club-shaped laterals and small, deep muscle scars are much alike.

The citation of this species from Michigan by Sager and Miles is certainly erroneous.

Genus LAMPSILIS Rafinesque, 1820.

Lampsilis RAFINESQUE, Ann. Gen. Sci. Phys. Brux., 1820, p. 298.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 345.

Shell oval to elliptical, smooth or slightly concentrically sculptured, usually without a posterior ridge; epidermis gen-

erally smooth and shining, often brilliantly rayed; beak sculpture, for the most part, consisting of fine, parallel ridges, which show a tendency to fall into an anterior and posterior loop; hinge with one or two pseudocardinals and one lateral in the right valve, and two pseudocardinals and two laterals in the left; female shell having a moderate and gradual inflation in the post-ventral region opposite the marsupium. Animal having the inner gills usually attached nearly or quite their entire length to the abdominal sack; marsupium occupying the hinder part of the outer gills; ovisacs distinct, separated by sulci, rounded below having a fold near their bases, the whole projecting below the inner gills; mantle edge double and thickened, often swollen behind into a sort of flap in the female.

Type: *Unio ovatus* Say.

The genus *Lampsilis* contains a large number of North American Uniones of a high type, usually having decidedly dimorphic shells. The marsupium is placed in the hinder part of the outer gills and consists of few to many distinctly marked ovisacs, the whole of somewhat different appearance from the rest of the gill, even when empty. The genus apparently does not rank so high as does *Truncilla*, as there is not such a remarkable difference between the shells of the sexes. In the female shells of the latter group the marsupial area is generally quite distinctly marked off from the rest of the shell, being thinner, of different texture, often suddenly inflated and radially ridged and toothed. In *Lampsilis* this area consists of a mere gradual inflation, sometimes quite feeble or hardly perceptible; it is rarely much thinner than the surrounding shell and never toothed or striated or of different texture.

The genus seems to be naturally divisible into four groups: *Lampsilis* typical, *Eurynia*, *Carunculina* and *Proptera*. I cannot be certain what Rafinesque's *Lampsilis cardium* is, but it is doubtless a member of the group to which *Unio ventricosus*, *capax* and *cariosus* belong. These species are characterized by inflated, large shells, the male and female being dimorphic, and having coarsely sculptured beaks. *Eurynia* contains the forms

with fine, doubly-looped beak sculpture: *Carunculina* is characterized by small, dark shells with singly-looped beak sculpture, and *Proptera* consists of generally large forms with a dorsal wing and purple nacre.

The shells of this genus are never arcuate, even in old age, and never biangulate. The posterior ridge is often wanting, and is seldom high or angulated.

Key to groups of Lampsilis.

Shell without a dorsal wing.
- Inflated, with coarse beak sculpture. Group of *L. ventricosa.*
- Shell solid.
  - Evenly long elliptical, feebly dimorphic, rayed. Gr. of *L. ligamentina.*
  - Short elliptical, strongly dimorphic, smooth, feebly rayed. Gr. of *L. orbiculata.*
  - Male shell sinuate at post-base; female shell highest. Gr. of *L. trabalis.*
  - Small; beak sculpture singly looped. Gr. of *L. texasensis.*
- Long elliptical, rayed.
  - Thin, evenly rounded behind; female much swollen at post-base. Gr. of *L. modioliformis.*
  - Rather solid, thinner behind, beak sculpture irregular. Gr. of *L. iris.*
- Long or short elliptical, strongly dimorphic; female shell obliquely truncate behind.
  - Smooth, scarcely rayed. Gr. of *L. anodontoides.*
  - Scarcely smooth. Gr. of *L. subrostrata.*
- Shell long, pointed behind.
  - Very glossy, brightly rayed. Gr. of *L. subangulata.*
  - Dull colored, feebly rayed. Gr. of *L. ellipsiformis.*
  - Compressed, elongated, dull colored. Gr. of *L. nasuta.*
- Shining, inflated, rayed, dimorphic; pseudocardinals small. Gr. of *L. luteola.*

Small, obovate, beak sculpture doubly looped.
Gr. of *L. amygdalum.*

Shell more or less dorsally winged when perfect.
Thin, decidedly gaping in front and behind.
Subinflated, dark, shining. Gr. of *L. amphichæna.*
Compressed, dull colored. Gr. of *L. leptodon.*
Shell inflated.
Thin, beaks smooth, feebly rayed. Gr. of *L. saladoensis.*
Solid, scarcely dimorphic. Gr. of *L. umbrosa.*
Large, obovate, strongly winged.
Strongly dimorphic, shell dark. Gr. of *L. alata.*
Scarcely dimorphic, thin. Gr. of *L. gracilis.*
Shell of medium size.
Obovate, bright copper-colored, subinflated.
Gr. of *L. metallica.*
Compressed, with a strong dorsal wing.
Gr. of *L. scutulata.*

Subgenus LAMPSILIS s. s.

Shell inflated, rather thin, shining, sometimes having a posterior ridge; beak sculpture coarse, consisting of a few more or less parallel ridges, which scarcely fall into loops. Animal having the mantle of the female usually toothed and thickened on the post-basal portion, which develops into a large, curious flap when the gills are filled with ova.

Type: *Unio ovatus* Say.

LAMPSILIS VENTRICOSA (Barnes).

Shell large, rather solid, obovate, inflated, with very full, high beaks, which have a few coarse, irregular corrugations that are inclined to be doubly looped; surface generally nearly smooth, the rest periods well marked; epidermis normally shining, greenish, greenish-yellow or brownish with broad, bright green rays. In old shells the rays are often nearly or quite wanting. Hinge line usually incurved in front of the beaks and outcurved behind them; ligament large and prominent, extending under the beaks, and narrow in front of them.

There are two, somewhat compressed pseudocardinals in the left valve, one in front of the other, the hinder high and having a triangular outline, the front lower, and both of these are in front of the beak; the hinge plate is narrow and rounded behind them, and there are two rather short, slender laterals; right valve with two compressed pseudocardinals, the lower the higher, separated by a deep, nearly parallel-sided socket, and one high, curved lateral, which is sharply truncated behind; beak cavities deep and wide; muscle scars not deep, smooth, the hinder semicircular; nacre brilliant, silvery, bluish-white or sometimes a beautiful pink.

In the female shell the marsupial swelling is pronounced, and the shell is generally higher than that of the male.

Length 130, height 90, diam. 60 mm.

Entire Mississippi drainage; St. Lawrence system; Nelson River and tributaries.

Type locality, Wisconsin River; Mississippi River, Prairie du Chien, Wis.

Unio ventricosus BARNES, Am. Jl. Sci. VI, 1823, p. 267, pl. XIII, fig. 14 (outline).—SAY, Am. Conch., No. IV, 1832, pl. XXXII.—HANLEY, Biv. Shells, 1843, p. 189, pl. XXIV, fig. 8. —CHENU, Bib. Conch., 1st ser. III, 1845, p. 45, pl. XII, figs. 1, 2.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLIII, fig. 235.

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

Margarita (Unio) ventricosus LEA, Syn., 1836, p. 23; 1838, p. 18.

Margaron (Unio) ventricosus LEA, Syn., 1852, p. 26; 1870, p. 41.

Lampsilis ventricosus BAKER, Moll, Chicago, Pt. 1, 1898, p. 94, pl. XII, figs. 3-5.—SMITH, Bull. U. S. Fish Com., 1899, p. 291, pl. LXXXIII.—SIMPSON, Syn., 1900, p. 526.

Lampsilis ventricosa STIMSON, Shells of N. Eng., 1851, p. 14.

Unio occidens LEA, Tr. Am. Phil. Soc., III, 1829, p. 435, pl. X, fig. 16; Obs., I, 1834, p. 49, pl. X, fig. 16.—KUSTER, Conch. Cab. Unio, 1856, p. 170, pl. LI, figs. 1, 2.—CHENU, Ill. Conch., 1858, pl. XII, figs. 5, 5*a*, 5*b*.

Margarita (Unio) occidens LEA, Syn., 1836, p. 23; 1838, p. 38.
Margaron (Unio) occidens LEA, Syn., 1852, p. 26; 1870, p. 41.
Unio subovatus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 118, pl. XVIII, fig. 46; Obs., I, 1834, p. 128, pl. XVIII, fig. 46.—HANLEY, Biv. Shells, 1843, p. 184, pl. XXII, fig. 43.—CHENU, Ill. Conch., 1858, pl. XII, figs. 6, 6*a*, 6*b*.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXI, fig. 163; 1868, pl. LXXXV, fig. 456.
Margarita (Unio) subovatus LEA, Syn., 1836, p. 19; 1838, p. 17.
Margaron (Unio) subovatus LEA, Syn., 1852, p. 24; 1870, p. 37.
Unio cardium CONRAD, New F. W. Shells, 1834, p. 68.—KUSTER, Conch. Cab. Unio, 1856, p. 169, pl. L, figs. 1-4.
Unio cardium Raf. v. *occidens* PÆTEL, Conch. Sam., III, 1890, p. 147.
Unio cardium Raf. v. *ventricosus* PÆTEL, Conch. Sam., III, 1890, p. 147.
Unio fasciolus FERUSSAC, Guer. Mag. 1835, p. 26.
Unio ovata DESHAYES, An. sans Vert., 3d ed., 1839, p. 669.
Unio ovatus KUSTER, Conch. Cab. Unio, 1852, p. 55, pl. XII, fig. 1.
Unio lenis CONRAD, Monog., XII, 1840, p. 106, pl. LVIII, fig. 2.
Unio canadensis LEA, Proc. Acad. N. Sci. Phila., I, 1857, p. 85; Jl. Ac. N. Sci. Phil., IV, 1860, p. 268, pl. XLIV, fig. 148; Obs., VII, 1860, p. 86, pl. XLIV, fig. 148.
Margaron (Unio) canadensis LEA, Syn., 1870, p. 37.
Unio dolabræformis SOWERBY, Conch. Icon., XVI, 1867, pl. LIX, p. 298.
Unio latissimus SOWERBY?, Conch. Icon., XVI, 1868, pl. LXVI, fig. 337.

Barnes only gave outline figures of this species; two of these are of females and one is of a male shell. Lea's *subovatus* is a male and his *occidens* is a bright colored form. One of his figures of the last is of a female, the other is of a male. Lea's *U. canadensis* appears to be a diseased or depauperate *ventri-*

cosus with a rather strongly developed posterior ridge. He has only the type in his collection and I have never seen anything like it elsewhere.

Var. *satura* (Lea).

A form rather common in southwestern waters. It is greatly inflated, with livid or smoky-colored, sometimes blackish epidermis, and the marsupial swelling is remarkably developed. It gradually merges into the type.

Southwestern States to Sabine River, Texas.

Type locality, Alexandria; Lake Calcashue, New Orleans, La.

Unio satur LEA, Pr. Am. Phil. Soc., V., 1852, p. 252; Tr. Am. Phil. Soc., X, 1852, p. 205, pl. XVII, fig. 19: Obs., V, 1852, p. 21, pl. XVII, fig. 19.—CHENU, Man., 1859, II, p. 138, fig. 666.—SOWERBY, Conch. Icon., XVI, 1868, pl. XCII, fig. 501.

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

Lampsilis ventricosus var. *satur* SIMPSON, Syn., 1890, p. 527.

Var. *lurida* n. v.

Throughout the St. Lawrence drainage a form is found, which is generally less inflated than the type, having lurid, ash-colored or smoky epidermis, which is lighter colored on the posterior ridge. This form is generally believed to be Lea's *Unio canadensis* and is rayless or feebly rayed, but it is really quite different from the specimen to which the great author gave that name. The form, which I call *lurida*, rarely has rays and when they are present they are dark smoky-brown. The typical *ventricosa* occurs more or less abundantly throughout the St. Lawrence area.

LAMPSILIS EXCAVATA (Lea).

Shell inflated, subsolid, the male irregularly ovate or rhomboid, the female obovate, with a high, decided posterior ridge; beaks high and full; ligament large, brown, extending forward in a narrow excavation in front of the beaks; epidermis smooth and shining on the disk, roughened and wrinkled on the somewhat truncated post-slope, tawny or greenish-yellow, showing a few green rays; hinge line with a slight double

curve, rounded in front of the beaks and out behind them; two pseudocardinals in the left valve, one behind the other, the anterior much the larger, with a triangular outline, both are compressed and situated in front of the beak; there are two small remote laterals and the middle of the hinge plate is narrow and rounded; right valve with two subcompressed, triangular pseudocardinals, the lower the larger, and one high lateral truncated behind; beak cavities deep and wide; muscle scars shallow, smooth; nacre white. The female shell is somewhat inflated at the post-basal outline; it is not so sharp at the posterior end as is the male shell. In the male shell the posterior point is about one half the distance up from the base to the top; in the female it is a little higher.

Length 85, height 65, diam. 50 mm.

Tombigbee and Alabama River drainage.

Type locality, Othcalooga Creek, Ga.

Unio excavatus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 32; Jl. Ac. N. Sci. Phila., IV, 1858, p. 71, pl. XIII, fig. 52; Obs., VI, 1858, p. 71, pl. XIII, fig. 52.—CHENU, Man., 1859, II, p. 138, fig. 665.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVII, fig. 403.

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

Lampsilis excavatus SIMPSON, Syn., 1900, p. 528.

? Unio ovatus SAY var. *ornatus* CONRAD, Monog., I, 1835, p. 4.

Unio ornatus SOWERBY, Conch. Icon., XVI, 1866, pl. XXXI, fig. 162.

LAMPSILIS BINOMINATA (Simpson).

Shell of moderate size, subsolid to rather thin, somewhat inflated, the male irregularly elliptical, the female obovate; posterior ridge not high, rounded; beaks only moderately full; their sculpture consisting of strong, slightly double-looped ridges; epidermis smooth, shining, showing the rest periods, wrinkled on the posterior slope, greenish, yellowish-green or tawny, showing a few narrow, generally sharply defined dark green rays; the teeth are much as in *L. excavata*, two compressed pseudocardinals in each valve, two laterals in the left

and one thin and truncated one in the right valve; the hinge plate is narrow and rounded in the middle; beak cavities only moderately deep, narrow; muscle scars rather shallow, smooth; nacre bluish or purplish-white. The female shell has a well-developed marsupial swelling.

Length 45, height 32, diam. 20 mm.

Chattahoochee and Flint Rivers, Georgia.

Type locality, Chattahoochee River, Columbus, Ga.

Unio lineatus LEA, Pr. Am. Phil. Soc., I, 1840, p. 287; Tr. Am. Phil. Soc., VIII, 1842, p. 206, pl. XII, fig. 20; Obs., III, 1842, p. 44, pl. XII, fig. 20.—CHENU, Ill., Conch., 1858, pl. XXVIII, figs. 1, 1*a*, 1*b*.—KUSTER, Conch. Cab. Unio, 1862, p. 278, pl. XCIV, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXI, fig. 309.

Margaron (Unio) lineatus LEA, Syn., 1852, p. 27; 1870, p. 41.

Lampsilis binominatus SIMPSON, Syn., 1900, p. 528.

This species differs from *L. excavata* in being smaller and less inflated; its beaks are not so full and high, the post-ridge is lower and more rounded, and the posterior part of the shell is not much wrinkled.

Lea's name was preoccupied by Valenciennes (Encyc. Meth., II, 1827, p. 151, pl. CCXLVIII, fig. 5) for what is probably *U. radiatus*. I changed it to *binominatus* in the Synopsis.

LAMPSILIS CARIOSA (Say).

Shell slightly obovate, rather thin to subsolid, scarcely inflated, with a moderately developed, rounded posterior ridge; beaks fairly developed, sculptured with a few coarse, parallel ridges, which are sometimes feebly doubly looped; surface smooth and shining, straw-color to tawny, sometimes rayed on the posterior slope; left valve with two compressed pseudocardinals, the hinder low and immediately under the beak, and two delicate, remote laterals; hinge plate rounded in the middle; right valve with one compressed pseudocardinal and generally a small one above it, and a single lamellar lateral, which is truncated behind. Beak cavities only moderately deep; anterior muscle scars shallow, smooth; posterior scars faint; na-

cre bluish-white, much thinner behind. The female shell has a well-developed marsupial swelling and is generally shorter and higher than that of the male.

Length 120, height 80, diam. 45 mm.

Length 105, height 63, diam. 35 mm.

Atlantic drainage from Georgia to the lower St. Lawrence. Type locality, Delaware and Schuylkill Rivers.

Unio cariosus SAY, Nich. Encyc., II, 1817, pl. III, fig. 2.—CONRAD, Monog., IV, 1836, p. 40, pl. XIX.—GOULD, Inv. of Mass., 1841, p. 111, fig. 72; Binney, Inv. of Mass., 1870, p. 172, fig. 475.—REEVE, Conch. Syst., I, 1841, p. 119, pl. LXXXIX, fig. 10.—DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 193, pl. XXI, figs. 243, 244.—HANLEY, Biv. Shells, 1843, p. 190, pl. XX, fig. 22.—KUSTER, Conch. Cab. Unio, 1852, p. 24, pl. I, figs. 2, 3.—SOWERBY, Conch. Icon., XVI, 1867, pl. LVIII, fig. 294.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 38, fig. 183.—SIMPSON, Naut., VIII, 1895, p. 122, 2 figures.

Margarita (Unio) cariosus LEA, Syn., 1836, p. 23; 1838, p. 18.

Margaron (Unio) cariosus LEA, Syn., 1852, p. 27; 1870, p. 42.

Lampsilis cariosus SIMPSON, Syn., 1890, p. 528.

Unio cariosa LAMARCK, An. sans Vert., VI, 1819, p. 80.

Mya cariosa EATON, Zool. Text-Book, 1826, p. 218.

Lampsilis cariosa STIMSON, Shells of N. Eng., 1851, p. 14.

Unio ovatus var. b. LAMARCK, An. sans Vert., VI, 1819, p. 75.

Unio ovata VALENCIENNES, Rec. Obs. Zool. Anat., II, 1833, p. 226, pl. L, figs. 1, 1*a*, 1*b*, 1*c*.

Unio viridis FERUSSAC, Guer. Mag., 1835, p. 27.

Unio oratus CONRAD, Ann. and Mag. Nat. Hist., IV, 1849, p. 301; Jl. Ac. N. Sci. Phila., 1850, p. 276, pl. XXXVII, fig. 6.

This species has frequently been confounded with *L. ochracea* Say, with which it is generally associated, but which is really a very different species. It is nearer to *L. ventricosa*, but is always smaller and more delicate in every way, more compressed and is seldom rayed except on the posterior slope.

The specimens referred to this species that are often reported from the Mississippi drainage are no doubt *L. ventricosa*.

LAMPSILIS ALTILIS (Conrad).

Shell rather thin, suboval, ovate or subelliptical, but moderately inflated; beaks not prominent; posterior ridge low, rounded, sometimes faintly double, so that the shell is slightly biangulate behind; epidermis straw-color or yellowish-brown to blackish, but smooth and rather shining, feebly rayed or rayless; hinge line with a single or double curve; left valve with two small, somewhat compressed pseudocardinals, one in front of the other, both placed just in front of the beak, and in the specimens seen, rather smooth, and two delicate, remote laterals; the central part of the hinge plate rounded; right valve with one pseudocardinal, sometimes with a feeble second above it, and one rather high, truncated lateral; beak cavities moderately deep, compressed; muscle scars smooth, rather shallow; nacre whitish or lurid.

Length 55, height 35, diam. 20 mm.

Alabama River drainage; Little Red River, Clinton, Arkansas?

Type locality, Alabama River, Claiborne, Ala.

Unio altilis CONRAD, New F. W. Shells, 1834, p. 43, pl. II, fig. 1, and p. 68.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 21, pl. 1, fig. 1.

Margarita (Unio) altilis LEA, Syn., 1836, p. 24; 1838, p. 19.

Margaron (Unio) altilis LEA, Syn., 1852, p. 27; 1870, p. 42.

Lampsilis altilis SIMPSON, Syn., 1900, p. 529.

In the few examples I have seen, the umbonal region is so eroded that nothing can be made out regarding the character of the beaks, which are probably not very full or high. The species differs from *L. cariosa* generally in its darker epidermis, its smaller and thinner shell, in showing slight biangulation behind and in the rather feeble post-basal swelling of the female. Conrad says that the nacre is whitish and iridescent, but all the specimens I have seen have a lurid nacre, often with a tinge of violet.

LAMPSILIS DOLABRÆFORMIS (Lea).

Shell large, inflated, subsolid, with extremely full, high beaks and a rather decided, sharply angled posterior ridge; elliptical to irregularly obovate, the posterior point rather blunt and situated nearly or quite half way up from the base of the shell; ligament rather large and long, running through forward under the beaks and showing in a narrow lunule in front; surface rather smooth, especially in the center of the shell, the growth lines strong and concentrically ridged on the anterior portion, the posterior slope often having a few faint radial ridges and wrinkles: color tawny-brownish, shining; left valve with two compressed pseudocardinals, one in front of the other, the anterior higher and placed just in front of the beak, sometimes these are split up into three imperfect teeth or they may all be united into one long, narrow ridge; there are two rather remote, curved laterals; the hinge line is very narrow and rounded in the center; right valve with two opposite pseudocardinals, the lower the higher, and one high, lamellar lateral sharply truncate behind; beak cavities deep and wide; muscle scars shallow, smooth; pallial line distinct; nacre white, pinkish or purplish.

Length 115, height 80, diam. 55 mm.

Savannah, Ogeechee, and Altamaha Rivers, Georgia.

Type locality, Altamaha River, Liberty Co., Ga.

Unio dolabræformis LEA, Tr. Am. Phil. Soc., VI, 1838, p. 103, pl. XXIV, fig. 113; Obs., II, 1838, p. 103, pl. XXIV, fig. 113.—HANLEY, Biv. Shells, 1843, p. 189, pl. XXI, fig. 47.—CHENU, Ill. Conch., 1858, pl. XXIII, figs. 6, 6*a*, 6*b*.—KUSTER, Conch., Cab., 1861, p. 170, pl. LII, figs. 1, 2.

Margarita (Unio) dolabræformis LEA, Syn., 1838, p. 18.

Margaron (Unio) dolabræformis LEA, Syn., 1852, p. 27; 1870, p. 41.

Lampsilis dolabræformis SIMPSON, Syn., 1900, p. 529.

A fine species resembling *L. capax* in some respects, but not so strongly inflated and having a sharper posterior ridge. It bears something the same relation to that species that *ovata* does to *ventricosa*. The marsupial swelling is rather feeble.

LAMPSILIS CAPAX (Green).

Shell greatly inflated, subsolid, obovate, with an excessively full, high, rounded umbonal region; the beak sculpture consisting of very faint, oblique ridges; surface generally smooth and somewhat shining, of a smoky, yellowish or reddish-brown, sometimes a smoky olive-color; rest marks distinct; ligament moderately long, passing forward under the beaks and appearing in front of them in a rather wide lunule; posterior ridge full and rounded; hinge line very strongly doubly curved; left valve with a single, sometimes a partially double, pseudocardinal in front of the beak, generally ragged and considerably compressed; the hinge line is narrow and rounded behind it, and has two small, compressed, distant laterals; right valve with two compressed, ragged pseudocardinals opposite each other, the upper extending back to the beak, and a single, high, thin, decidedly truncate lateral; beak cavities deep and very wide; muscle scars shallow, smooth; pallial line distinct; nacre bluish-white, pinkish or salmon-tinted. The shells are all full at the posterior base, those of the female but little more inflated in that region than are the males.

Length 115, height 80, diam. 70 mm.

Lower Ohio River drainage; southwest to St. Francis River, Arkansas; north to eastern Iowa; Elkhorn and Blue Rivers, Nebraska? (Aughey).

Type locality, Falls of St. Anthony; Bayou Teche.

Unio capax GREEN, Cab. Nat. Hist., II, 1832, p. 290.—CONRAD, Monog., IX, 1837, p. 75, pl. XLII.—KUSTER, Conch. Cab. Unio, 1852, pp. 21, 65, pl. XV, fig. 3.—SOWERBY, Conch. Icon., XVI, 1866, pl. LII, fig. 274.

Margaron (Unio) capax LEA, Syn., 1852, p. 27; 1870, p. 42.

Lampsilis capax SMITH, Bull. U. S. Fish Com., 1899, p. 291, pl. LXXXIV.—SIMPSON, Syn., 1900, p. 529.

Symphynota globosa LEA, Tr. Am. Phil. Soc., V, 1832, p. 41, pl. IV, fig. 12; Obs., I, 1834, p. 153, pl. IV, fig. 12.

Margarita (Unio) globosa LEA, Syn., 1836, p. 23.

Margarita (Unio) globosus LEA, Syn., 1838, p. 18.

Unio globosus HANLEY, Test. Moll., 1842, p. 188.

A species, which seems to be only locally abundant, being found in the Mississippi in considerable quantities at various points in Iowa, notably Davenport and the mouth of the Iowa River. It is very much inflated, having the fullest umbonal region of perhaps any Unione known; the hinge line is remarkably curved, the epidermis almost invariably has a smoky hue and is rayless, and the shell gapes at the anterior base and the posterior end.

LAMPSILIS OVATA (Say).

Shell subrhomboid to elliptical, solid, somewhat inflated, with high, full beaks, which have a few coarse ridges nearly parallel with the growth lines; posterior ridge high and sharp; surface with irregular, rude growth lines; epidermis rather smooth and shining on the disk, somewhat roughened and wrinkled on the posterior slope, straw-color, tawny, pale olive or brownish, rayless or feebly rayed; ligament large and prominent; left valve with two somewhat compressed pseudocardinals in front of the beak, the hinder the smaller, with two rather short, distant laterals, the middle of the hinge plate narrowed and rounded; right valve with two opposite pseudocardinals, separated by a deep, parallel-sided socket, the upper smaller and much compressed, with one remote, high, sharply truncate lateral; beak cavities deep, not wide; muscle scars shallow, smooth, the hinder large, rounded or semilunar; nacre whitish. The female shell is but slightly inflated in the postbasal region.

Length 140, height 95, diam. 55 mm.

Ohio River drainage; Rome, Georgia?

Type locality, Ohio River and its tributary streams.

Unio ovatus SAY, Nich. Encyc., II, 1817, pl. II, fig. 7.—CONRAD, Monog., I, 1835, p. 4, pl. II.—KUSTER, Conch. Cab Unio, 1852, p. 22, pl. III, fig. 2.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXI, fig. 164.

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

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

Lampsilis ovatus SIMPSON, Syn., 1900, p. 530.

Unio ovata LAMARCK, An. sans Vert., VI, 1819, p. 75.—? VALENCIENNES, Coq. Marines, Biv., 1833, pl. L, figs. 1, 1*a*, 1*b*, 1*c*.
Lampsilis ovata RAFINESQUE, Ann. Gen. Sci. Phys. Brux., V, 1820, p. 298.
Mya ovata EATON, Zool. Text-Book, 1826, p. 218.
Æglia ovata SWAINSON, Treat. on Mal., 1840, p. 266, fig. 49.

This species is characterized by its strong, sharp posterior ridge, which is generally wanting, or low, in *L. ventricosa*. The only other species of the group which has a similarly developed ridge is *L. excavata*, which is a smaller, more inflated and usually rayed form with the marsupial swelling more distinctly developed.

The name *ovatus* was used for *Unio tumidus* Retz, by Lister, Donovan, and others, but as it was called a *Mya* and the generic name *Unio* was never used with it, it can stand for Say's species.

LAMPSILIS OCHRACEA (Say).

Shell thin, subinflated, elliptical, with rather full beaks, which are sculptured with a few straight, strong ridges; posterior ridge well developed, and ending in a blunt point about half way up from the base of the shell; epidermis dull, scarcely shining, tawny-brownish, generally lurid or smoky and lamellated over the posterior part of the shell, generally feebly rayed; left valve with two rather small pseudocardinals in front of the beaks, which are compressed and often grown together, the anterior the highest, with two thin, remote laterals; the hinge line is narrow and rounded at the middle; right valve with two triangular, compressed pseudocardinals opposite each other and separated by a deep, narrow pit, the upper the smaller, and a thin, truncated lateral; muscle scars shallow; beak cavities moderate; nacre lurid, tinged with reddish or purplish.

Length 115, height 70, diam. 60 mm.

Length 80, height 50, diam. 35 mm.

Atlantic drainage, from New England to the Ogeechee River, Georgia.

Type locality, Delaware and Schuylkill Rivers.

Unio ochraceus SAY, Nich. Encyc., 1817, pl. II, fig. 8.—CONRAD, Monog., IV, 1836, p. 37, pl. XVIII, fig. 2.—GOULD, Inv. Mass., 1841, p. 112, fig. 74; 1870, p. 173, fig. 476—HANLEY, Biv. Shells, 1843, p. 190, pl. XX, fig. 48?—DE KAY, Zool., of N. Y., Pt. 5, 1843, p. 193, pl. LXIX, figs. 237, 238.—KUSTER, Conch. Cab. Unio, 1856, p. 163, pl. XLVII, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXIII, fig. 317.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 39, fig. 184.—SIMPSON, Nautilus, VIII, 1895, p. 122, fig.

Margaron (Unio) ochraceus LEA, Syn., 1852, p. 27; 1870, p. 42.

Lampsilis ochraceus SIMPSON, Syn., 1900, p. 530.

Mya ochracea EATON, Zool. Text-Book, 1826, p. 218.

Symphynota ochracea LEA, Tr. Am. Phil. Soc., III, 1830, p. 455; Obs. I, 1834, p. 69.

Margarita (Unio) ochracea LEA, Syn., 1836, p. 23; 1838, p. 18.

Lampsilis ochracea STIMPSON, Shells of N. Eng., 1851, p. 14.

Unio crocatus LEA, Pr. Am. Phil. Soc., II, 1841, p. 31; Tr. Am. Phil. Soc., VIII, 1842, p. 238, pl. XXII, fig. 52; Obs., III, 1842, p. 76, pl. XXII, fig. 52.—CHENU, Ill. Conch., 1858, pl. XXXIII, figs. 1, 1*a*, 1*b*.

Margaron (Unio) crocatus LEA, Syn., 1852, p. 27; 1870, p. 42.

Unio rosaceus CONRAD, Pr. Acad. N. Sci., Phila., IV, 1849, p. 153; Jl. Acad. N. Sci. Phila., I, 1850, p. 275, pl. XXXVII, fig. 5.

Unio troostensis SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVIII, fig. 210.

Unio affinis SOWERBY? Conch. Icon., XVI, 1868, pl. LXIII, fig. 318.

A species which does not seem to be very closely allied to any member of the group unless it may be *L. delumbis*. Its thinness, the rather sharp posterior ridge, the general smoky tint of the epidermis and the peculiar reddish or violaceous nacre are its principal characters.

LAMPSILIS SPLENDIDA (Lea).

Shell somewhat elongated, subsolid, greatly inflated, with very full, high beaks and a strong, rather sharp posterior ridge,

with generally a faint ridge above it; beak sculpture consisting of strong, nearly straight bars; epidermis slightly concentrically wrinkled, yellowish-green to reddish-ash with numerous wide or narrow, faint green rays, scarcely shining. The old shells are sometimes dark brownish and apparently rayless. Female shell with a rather strong marsupial swelling, the male is often a little swollen behind the middle of the base; left valve with two rather small, usually subcompressed, pseudocardinals, the posterior at some little distance in front of the beak, and two remote laterals, the lower the larger; hinge line greatly narrowed and rounded under the beaks; right valve with two pseudocardinals, the upper narrow and small, the one lateral truncate behind. Beak cavities deep and wide; posterior muscle scars shallow, semicircular; nacre pale lurid violet, sometimes bluish.

Length (male) 95, height 52, diam. 45 mm.

Length (female) 95, height 63, diam. 45 mm.

Altamaha and Ogeechee Rivers, Georgia.

Type locality, Altamaha River, Darien, Ga.

Unio splendidus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 70, pl. XIX, fig. 61; Obs., II, 1838, p. 70, pl. XIX, fig. 61.—KUSTER, Conch. Cab. Unio, 1852, p. 55, pl. XII, fig. 2.—CHENU, Ill. Conch., 1858, pl. XVII, figs. 7, 7*a*, 7*b*.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXI, fig. 161.

Margarita (Unio) splendidus LEA, Syn., 1836, p. 23; 1838, p. 18.

Margaron (Unio) splendidus LEA, Syn., 1852, p. 27; 1870, p. 42.

Lampsilis splendidus SIMPSON, Syn., 1900, p. 531.

Unio regularis SOWERBY, Conch. Icon., XVI, 1868, pl. XXXIV, fig. 181.

A somewhat peculiar and rather variable species. The female shell is higher than that of the male, and more blunt behind. It is probably most nearly related to *L. ochracea* Say, but does not approach very nearly to anything.

LAMPSILIS DELUMBIS (Conrad).

Shell long ovate, very thin and fragile, ventricose; ligament margin slightly elevated; anterior side rather narrow; posterior margin rounded; epidermis olivaceous, with green rays; umbonal slope rounded; beaks only moderately full; margin of the ligament slope rounded, very oblique; within bluish, highly iridescent; cardinal teeth lamellar; cavity capacious.

Length 54, height 30 mm.

Type locality, small streams near Cooper River, South Carolina.

Unio delumbis CONRAD, New F. W. Shells, 1834, p. 35, pl. v, fig. 3.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 18, pl. II, fig. 10.

Lampsilis delumbis SIMPSON, Syn., 1900, p. 531.

I have never seen this species that I know of, and am somewhat uncertain as to its relationships, as Conrad says nothing of its beaks or their sculpture. My description of the species is made up from his description and figure. He gives no measurements, but it is probable that his figure is life-size, as are the rest of them in the New Fresh Water Shells, and I have given the measurements of this figure. It is possible that this may belong to the group of *L. iris*. It looks something like an elongated *L. ochracea*.

LAMPSILIS PEROVALIS (Conrad).

Shell rather solid and inflated, obovate rather short; beaks high, but only moderately full, situated about two-fifths of the distance from the anterior to the posterior end; their sculpture consists of strong, slightly doubly-looped ridges; posterior ridge well developed and ending in a blunt point behind about midway up from the base; epidermis greenish-yellow or greenish-tawny, with faint rays, smooth and shining in the middle of the disk, a little wrinkled and duller colored at the ends; left valve with two rather strong pseudocardinals in front of the beak, which are rather solid and slightly compressed, the anterior the higher; there are two short, distant laterals, the lower the

higher; a rounded, narrowed hinge plate; and one pseudocardinal in the right valve, with a small, narrow one above it, and one rather solid lateral, truncate behind; muscle scars well marked, smooth; nacre silvery. The female shell has a strongly developed marsupial swelling.

Length 53, height 37, diam. 25 mm.

Alabama and Black Warrior Rivers.

Type locality, Alabama River, Claiborne, Ala.

Unio perovalis CONRAD, New F. W. Shells, 1834, p. 43, pl. II, fig. 2; p. 71.—CHENU, Bib. Conch, 1st ser., III, 1845, p. 21, pl. I, fig. 2.—KUSTER, Conch. Cab. Unio, 1861, p. 257, pl. LXXXVII, fig. 2.

Margarita (Unio) perovalis LEA, Syn., 1836, p. 24; 1838, p. 19.

Margaron (Unio) perovalis LEA, Syn., 1852, p. 27; 1870, p. 42.

Lampsilis perovalis SIMPSON, Syn., 1900, p. 531.

I have seen specimens of what are undoubtedly this from the type locally and they are close to *L. clarkiana* and *L. doliaris*. It is a little shorter than the former, and is less sharply pointed behind; it is not quite so much inflated as the latter and the marsupial swelling is possibly a little fuller than in either of these species; the texture differs a little from that of the other two. However it is quite probable that they all run together, as the combined differences of the three, so far as I have been able to examine material, are less than is seen in *L. ventricosa*.

LAMPSILIS CLARKIANA (Lea).

Shell becoming very solid when fully adult, long elliptical, with only moderately full, high beaks, rather inflated, with a strong, dark ligament, which scarcely shows in front of the beaks; surface smooth except at the ends of the shell, shining, the epidermis being greenish-yellow, olivaceous or tawny, sometimes brownish or blackish and having a peculiar smoky, soft tint as if almost waxy, faintly rayed or rayless; posterior ridge well developed and ending rather below the middle of the height of the shell; left valve with two solid pseudocardinals in front of the beak; these are subcompressed when young,

but solid when the shell is adult; the posterior is triangular; there are two strong laterals, the lower the heavier; the hinge line is rounded and narrow in the middle; right valve with a heavy pseudocardinal, with a small tooth often behind it and a compressed small one above it; there is a single, strong, truncate lateral; beak cavities moderately deep; muscle scars well impressed, smooth; nacre whitish, often salmon in the center of the shell. The female shell is not greatly inflated at the posterior region.

Length 85, height 55, diam. 40 mm.

Length 65, height 45, diam. 30 mm.

Type locality, Williamsport, Tennessee; also near Columbus, Mississippi; Cahawba and Black Warrior Rivers, Alabama.

Unio clarkianus LEA, Pr. Am. Phil. Soc., V, 1852, p. 251; Tr. Am. Phil. Soc., X, 1852, p. 273, pl. XXI, fig. 30; Obs., V, 1852, p. 29, pl. XXI, fig. 30.

Margaron (Unio) clarkianus LEA, Syn., 1852, p. 27; 1870, p. 42.

Lampsilis clarkianus SIMPSON, Syn., 1900, p. 532.

Unio spillmanii LEA, Pr. Ac. N. Sci. Phila., XIII, 1861, p. 39; Jl. Acad. N. Sci. Phila., V, 1862, p. 98, pl. XV, fig. 246; Obs., VIII, 1862, p. 102, pl. XV, fig. 246.

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

When fully matured this has one of the most solid shells of any species in the group. Even the young shells are quite heavy. This solidity, its heavy teeth and the peculiar waxy texture of the shell are its best distinguishing characters. I believe it to be absolutely identical with the *Unio spillmanii* of Lea. The habitat "Williamsport, Tennessee," given by Lea, is open to doubt. He also gives Georgia or Alabama on the authority of Wheatley and it is found in both of these states.

LAMPSILIS GERHARDTII (Lea).

Shell subrhomboid, but slightly inflated, subsolid, with only moderately high beaks; there is a rather long ligament, which runs forward under the beaks and is embedded in front of them in a narrow lunule; posterior ridge well developed,

rounded, ending near the base of the shell in a rounded point; surface somewhat concentrically sulcate, shining, with a few narrow rays, greenish-yellow; hinge plate solid; left valve with two rather strong pseudocardinals, the anterior under the beak, more elongated, stumpy, with two sub-remote laterals, the lower a little the larger; right valve with one strong pseudocardinal and a small one above it, with an irregular, low tooth under the beak and one high, truncate lateral; muscle scars well marked, smooth, the posterior ones round; nacre bluish-white, silvery, iridescent behind.

Length 70, height 46, diam. 26 mm.

Type locality, Chattanooga (river?), Georgia. Also, Shorter, Alabama.

Unio gerhardtii LEA, Pr. Acad. N. Sci. Phila., VI, 1862, p. 168; Jl. Ac. N. Sci. Phila., V, 1862, p. 208, pl. XXXI, fig. 277; Obs., IX, 1863, p. 30, pl. XXXI, fig. 277.

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

Lampsilis gerhardtii SIMPSON, Syn., 1900, p. 532.

The only specimen I have seen is a male, and I am not positive whether it would be placed here or in the *luteola* group, as the beaks are too badly eroded to give any indication of the beak sculpture. It has some characters like *L. straminea* Conrad.

LAMPSILIS MULTIRADIATA (Lea).

Shell elliptical or subovate, rather solid, somewhat inflated; ligament long; beaks not prominent, sculptured with rather coarse, irregular, corrugated ridges, which have a tendency to be doubly looped; posterior ridge low, rounded; epidermis with very fine, concentric laminæ, generally shining, greenish-yellow with very many wavy rays covering the whole shell; sometimes a number of the green rays are blended together; the umbonal region is generally brownish; left valve with two rather delicate, elevated, sometimes subcompressed, pseudocardinals and two short remote laterals, the inner the higher; hinge line rounded; right valve with one high pseudocardinal with a small, compressed one above it, and sometimes a vestige

of a third behind, and one truncated lateral; beak cavities moderate: muscle scars shallow, smooth; nacre bluish. The female shell has often a decided marsupial swelling.

Length (male) 70, height 45, diam. 25 mm.

Length (male) 77, height 50, diam. 32 mm.

Length (female) 60, height 45, diam. 25 mm.

Entire Ohio River drainage; Southern Michigan; New York? (Marshall).

Type locality, Ohio.

Unio multiradiatus LEA, Tr. Am. Phil Soc., III, 1829, p. 434, pl. IX, fig. 15; Obs., I, 1834, p. 48, pl. IX, fig. 15.—HANLEY, Biv. Shells, 1843, p. 190, pl. XXI, fig. 10.—CHENU, Ill. Conch., 1858, pl. XII, figs. 2, *2a*, *2b*.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXX, fig. 506*a*.

Margarita (Unio) multiradiatus LEA, Syn., 1836, p. 24; 1838. p. 19.

Margaron (Unio) multiradiatus LEA, Syn., 1852, p. 31; 1870, p. 42.

Lampsilis multiradiatus SIMPSON, Syn., 1900, p. 532.

Unio fasciolus SAY, Am. Conch., VI, 1834.—CONRAD, Monography, III, 1836, p. 26, pl. XI, fig. 2.—KUSTER, Conch. Cab. Unio, 1852, p. 32, pl. V, fig. 4.

Unio perradiatus LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 40; Jl. Ac. N. Sci. Phila., V, 1862, p. 66, pl. VI, fig. 215; Obs., VIII, 1862, p. 70, pl. VI, fig. 215.

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

Unio altilis REEVE, Conch. Icon., XVI, 1865, pl. XXIII, fig. 109.

Unio perovalis SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVIII, fig. 209.

This species is not very closely related to any other form. Its best distinguishing character is the numerous rays which cover the entire shell except the beaks, which are often brownish in well-preserved specimens.

LAMPSILIS DOLIARIS (Lea).

Shell irregularly elliptical, inflated, subsolid, with moderately full, high beaks and a decidedly developed, rounded posterior ridge, which is sometimes faintly double and ends in a

blunt, somewhat drawn out point at the middle of the height of the shell; the disk is rather smooth, epidermis wrinkled in front and behind, greenish-yellow or brownish, somewhat lurid; there are a few narrow or hair-like wavy rays, usually arranged in groups; ligament rather long, scarcely developed in front of the beaks; left valve with two rather stumpy pseudocardinals, which are scarcely compressed, placed in front of the beak and two short laterals; hinge plate narrowed and rounded for a long distance; right valve with one stumpy pseudocardinal and sometimes a small one above it, with a single, somewhat truncated lateral behind; muscle scars well impressed, smooth; nacre dirty bluish-white, lurid in the cavity of the shell. The female shell is but little more inflated in the post-basal region than that of the male. Both are somewhat angled a little behind the middle of the base.

Length 60, height 40, diam. 28 mm.

Alabama and Tombigbee drainage.

Type locality, Etowah River, Ga.

Unio doliaris LEA, Pr. Ac. N. Sci. Phila., XVII, 1865, p. 88; Jl. Ac. N. Sci. Phila., VI, 1868, p. 260, pl. XXXII, fig. 75; Obs., XII, 1869, p. 20, pl. XXXII, fig. 75.

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

Lampsilis doliaris SIMPSON, Syn., 1900, p. 533.

The best distinguishing characters of this species are the angulation just behind the center of the base, from which there is an almost straight line to the hinder part of the shell, and the almost beak-like posterior point, which is sometimes slightly biangulate. The clustered rays seem to be a fairly constant character. I am rather doubtful, though, whether it is a valid species.

LAMPSILIS BREVICULA (Call).

Shell obovate, thin, subcompressed, with a very low, ill-defined posterior ridge; beaks rather low; ligament long, passing under the beaks and appearing in front in a small lunule; surface nearly smooth, greenish straw-colored, having a smoky tint, with a few delicate, broken rays on the posterior half;

these rays are sometimes scarcely perceptible and at other times they break into crescentic or arrow-head spots; left valve with two delicate, subcompressed pseudocardinals placed just in front of the beak, the anterior generally the higher, and two distant, rather short, delicate laterals, the inner the higher; hinge line narrow and rounded in the middle; right valve with a somewhat compressed pseudocardinal, with a smaller one above it separated by a deep, parallel-sided pit, with often a vestige of another tooth behind, and a single lateral decidedly truncate posteriorly; beak cavities not deep; muscle scars shallow, smooth; nacre whitish, purple tinted, buff-colored in the cavity of the shell. The female shell is shorter and higher than that of the male and strongly inflated post-basally, the low posterior ridge ends in a decided point about three-fifths of the way up from the base; the male shell is more blunt or even widely rounded or subtriangulate behind.

Length (male) 47, height 27, diam. 17 mm.

Length (female) 44, height 31, diam. 15 mm.

Type locality, Current River and tributaries, Jack's Ford, and Big Creek, Shannon Co., Missouri. Also, Arkansas.

Unio breviculus CALL, Pr. U. S. Nat. Mus., X, 1887, p. 499, pl. XXVIII; Tr. Ac. Nat. Sci., St. Louis, VII, 1895, p. 6, pl. XVII.

Lampsilis breviculus SIMPSON, Syn., 1900, p. 533.

I cannot be certain as to the relationships of this species. The female is a good deal like a small, very delicate *L. cariosa,* but the tint of color is softer, especially that of the nacre, which is silvery, and the rays are different.

Var. *brittsi* Simpson.

Shell more elongated than the type, with deeper sinus behind the marsupial swelling and more distinctly rayed.

Lampsilis brittsi SIMPSON, Pr. Ac N. Sci. Phila., 1900, p. 76, pl. V, figs. 1, 2.

Lampsilis breviculus var. *brittsi* SIMPSON, Syn., 1900, p. 533.

Quite different from the type but rather variable, and in deference to the opinions of some of our best conchologists I have reduced it to the rank of a variety of *brevicula.*

LAMPSILIS BIANGULARIS (Lea).

Shell elliptical, obovate or subrhomboid, generally inflated, solid, with rather full but not high beaks, with a high, angled posterior ridge and a lower one above it ending in a biangulation at the posterior end a short distance above the base; epidermis smooth and shining in the younger shells, which are greenish-yellow with faint broken dark rays; in the old shells it is dark, often blackish, and somewhat roughened; ligament large, feebly developed in front of the beaks; left valve with two generally high and somewhat compressed, but sometimes stumpy, pseudocardinals, the hinder under the beak, and two rather distant laterals, the hinge line narrowed and rounded in front of them; right valve with one pseudocardinal with a small one above it, and one high, truncate lateral; beak cavities rather deep and compressed; muscle scars deep, smooth; nacre lurid, dull bluish, or purplish-white. The female shell has only a slightly developed marsupial swelling.

Length 95, height 62, diam. 35 mm.

Length 90, height 50, diam 37 mm.

Tennessee drainage.

Type locality, Caney Fork River, Tennessee.

Unio biangularis LEA, Pr. Am. Phil. Soc., I, 1840, p. 288.

Unio biangulatus LEA, Tr. Am. Phil. Soc., VIII, 1843, p. 197, pl. IX, fig. 8; Obs., III, 1842, p. 35, pl. IX, fig. 8.—CHENU, Ill. Conch., 1858, pl. XXX, figs. 7, *7a*, *7b*.—KUSTER, Conch. Cab. Unio, 1861, p. 189, pl. LX, fig. 1; pl. LXI, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXX, fig. 421.

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

Lampsilis biangulatus SIMPSON, Syn., 1900, p. 533.

A very variable species in form, epidermis and solidity. It probably groups here, though its relations are not very close to any other members of this assemblage. It is sometimes difficult to separate specimens of this species from *L. perdix*, which I have placed in the *ligamentina* group.

Subgenus EURYNIA Rafinesque, 1820.

Eurynia RAFINESQUE, Ann. Gen. Sci. Phys. Brux., 1820, p. 297.—ORTMANN, Ann. Carnegie Mus., VIII, 1912, p. 336.

Shell oval to oblong; beak sculpture delicate, doubly looped; mantle double edged and often toothed below; that of the female sometimes developed into a thickened flap at the post-base.

Type, *Unio recta* Lamarck.

Ortmann gives this generic rank with *Micromya* and *Carunculina* as subgenera. A number of the species that I have included in *Eurynia,* he considers to belong to his restricted genus *Lampsilis* and to *Nephronaias.* I have indicated in the synonymy the several species that he refers to *Eurynia* and *Nephronaias.*

Group of *Lampsilis luteola.*

Shell inflated, shining, generally rayed; beak sculpture often broken, with the posterior loop open behind; pseudocardinals rather small, compressed, smooth inside, and often curved slightly upward. Female shell having a strongly-developed, rounded marsupial swelling.

LAMPSILIS LUTEOLA (Lamarck).

Shell oblong, solid, subinflated or inflated, rather higher behind with moderately full beaks; beak sculpture consisting of exceedingly fine, doubly-looped ridges, the hinder loops which are sometimes turned up behind and sometimes open; rarely the sculpture is a little corrugated or broken; surface with somewhat irregular growth lines, sometimes slightly concentrically sculptured, the rest periods few and usually well marked; epidermis smooth and shining, generally straw-colored, yellowish or greenish-yellow, often becoming brown in old shells, and normally exhibiting bright rays throughout, which may be narrow or wide; ligament long, sometimes showing in a narrow lunule in front of the beaks; left valve with two pseudocardinals, which are usually a little compressed, the hinder under the beak, the anterior higher and larger, and two long, rather near laterals, the hinge plate much narrowed

at their anterior end; right valve with two pseudocardinals, the lower much the larger, and one lateral, which is sometimes a little truncate behind; muscle scars large, well marked, smooth; beak cavities rather shallow, exhibiting a row of four or five dorsal scars; pallial line well marked; nacre white, bluish-white, straw-colored or pink, usually bright, thicker in front. Female shell with a most decided marsupial swelling, and having the blunt posterior point somewhat higher up (three-fifths of the height) than that of the male (about half way up), and it is usually more inflated.

Length (male) 100, height 60, diam. 40 mm.

Length (female) 105, height 57, diam. 50 mm.

Entire Mississippi drainage, southwest to the Brazos River, Texas; St. Lawrence drainage, entire Dominion of Canada east of the Rocky Mountains.

Type locality, Susquehanna and Mohawk Rivers.

Unio luteola LAMARCK, An. sans Vert., VI, 1819, p. 79.

Unio luteolus DE KAY, Zool. of New York, Pt. 5, 1843, p. 190, pl. XX, fig. 241.—HANLEY, Biv. Shells, 1843, p. 192, pl. XXIII, fig. 16.—SOWERBY, Conch. Icon., XVI, 1867, pl. LVIII, figs. 293, 293*a*, 293*b*.—CALL, Tr. Acad. Sci., St. Louis, VII, 1895, p. 25, pl. III.

Margarita (Unio) luteolus LEA, Syn., 1836, p. 25; 1838, p. 19.

Margaron (Unio) luteolus LEA, Syn., 1852, p. 28; 1870, p. 44.

Lampsilis luteolus BAKER, Moll. Chicago, Pt. 1, 1898, p. 103, pls. XI, XXXVII, fig. 12.—SIMPSON, Syn., 1900, p. 534.

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

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

Unio siliquoideus BARNES, Am. Jl. Sci., VI, 1823, p. 269, pl. XIII, fig. 150 (outline).—CONRAD, Monog., II, 1836, p. 22, pl. X, fig. 1.

Unio siliquoides KUSTER, Conch. Cab. Unio, 1852, p. 30, pl. V, fig. 2.

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

Lampsilis siliquoidea STIMPSON, Shells of New Eng., 1851, p. 14.

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

Unio hydianus KUSTER, part, Conch. Cab. Unio, 1861, p. 201, pl. LXVII, fig. 1.

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

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

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

Var. *rosacea* (De Kay).

Shell smaller and more delicate than the type, generally less brightly colored, often nearly or quite rayless; epidermis brownish or pale greenish-yellow; nacre white, bluish or rose-tinted.

Length 60, height 37, diam. 20 mm.

The St. Lawrence and Mackenzie areas.

Type locality, Seneca Lake, N. Y.

Unio rosaceus DE KAY, Zool. of New York, V, 1843, p. 192, pl. XXXIX, figs. 355, 356; pl. XL, fig. 357.

Lampsilis luteolus var. *rosaceus* SIMPSON, Syn., 1900, p. 535.

One of the most abundant, widely distributed Uniones in the world. It probably extends down the Mackenzie River to near the Arctic Ocean and nearly to the mouth of the St. Lawrence. It does not seem to be abundant in Kentucky or the Tennessee River System. In the southwest it is mostly replaced by the closely allied *L. hydiana*, which is often taken for this species. The variety *rosacea* of De Kay has typically a beautiful rose-colored nacre, the color in many cases showing through the epidermis, but in a majority of cases this form has a smoky, brownish, bronzy or lurid ash-colored epidermis with feeble rays. So far as I know the variety is found only in the St. Lawrence and northward, but fairly typical specimens occur throughout this region.

LAMPSILIS SUPERIORENSIS (Marsh).

Shell long-obovate, subcompressed, subsolid, without a posterior ridge; beaks rather low; ligament prominent, brown; surface covered with irregular, coarse growth lines, sometimes almost sulcate, and having a limited number of faint rays;

epidermis slightly wrinkled, straw-color or greenish-yellow. Left valve with two small pseudocardinals and two somewhat remote laterals, the former just in front of the beak; right valve with two pseudocardinals, the upper one smaller and compressed, and a single, high, truncated lateral; beak cavities shallow; anterior muscle scars rather deep, posterior scars semicircular; nacre bluish-white, dull, often with a lurid blotch in the cavity of the shell.

Length 58, height 34, diam. 20 mm.

Upper Great Lakes region.

Type locality, Michipicoten River, north shore of Lake Superior.

Unio superiorensis MARSH, Naut. X, 1897, p. 103, pl. 1, figs. 1, 2, 5.

Lampsilis superiorensis SIMPSON, Syn., 1900, p. 535.

Close to *Lampsilis luteola* and possibly a variety of it. This and *L. borealis* form connecting links between *L. luteola* and *L. radiata*, though they appear to be as well worthy of specific rank as a large number of our forms. The present species is smaller and rather more compressed than the *L. luteola*, the texture of the shell is different; it is not so bright and shining as that species and it has a duller nacre.

LAMPSILIS BOREALIS (A. F. Gray).

Shell solid, inflated, long obovate, sometimes having a slight posterior ridge; beaks rather full but not high; epidermis having fine, concentric folds, often wrinkled in front, scarcely shining; surface with few to many rather feeble, dark greenish rays on a greenish-brown or brown ground; left valve with two stumpy pseudocardinals, the hinder under or a very little forward of the beak, and two rather remote, straight laterals; right valve with one strong, roughened pseudocardinal, a small, compressed one above it, and one high, subtruncated lateral; beak cavities rather deep and wide, with a few impressed dorsal pits; anterior scars smooth, deep; posterior scars faint; nacre whitish or bluish-white, dull, often having lurid blotches. The male shell is more elongated, more pointed behind than the female, which has a slight swelling just behind

the center of the base. The shells of both male and female are much thickened in front.

Length (male) 72, height 42, diam. 32 mm.

Length (female) 63, height 40, diam. 31 mm.

Lower St. Lawrence drainage, to Lake Michigan; Lake of the Woods.

Type locality, Duck Island, Ottawa River, Ont.

Unio borealis A. F. GRAY, Tr. Ottawa Field Nat. Club, 1882, p. 53, pl.

Lampsilis borealis SIMPSON, Syn., 1900, p. 535.

This species combines the characters of *Lampsilis luteola* and *radiata*. It often closely approaches the form of the former, but is generally more inflated. It has, however, the texture and roughened epidermis as well as much the same color as the latter.

LAMPSILIS RADIATA (Gmelin).

Shell long obovate, subsolid, subcompressed; posterior ridge feeble or wanting; beaks rather sharp but not full or high, with delicate, doubly-looped sculpture; epidermis concentrically wrinkled, often looped, showing numerous more or less distinct rays on a yellowish or brownish-green ground; the left valve has two pseudocordinals, the hinder under the beak, and two straight laterals; the right valve has two pseudocardinals, the upper smaller and compressed, and a single subtruncated lateral; beak cavities not deep, compressed; muscle scars shallow; nacre bluish-white, sometimes dirty salmon reddish or purplish, dull, somewhat thickened in front. The female shell is shorter than that of the male, it is wider at the posterior end. The male shell is often somewhat drawn out and feebly biangulate.

Length (male) 90, height 50, diam. 27 mm.

Length (female) 80, height 52, diam. 27 mm.

Mya radiata GMELIN, Syst. Nat., 13th ed., 1792, p. 3220.—WOOD, Index Test., 2d ed., 1825, p. 12, pl. II, fig. 2.—HANLEY, Index Test., 3d ed., 1856, p. 16, pl. II, fig. 32.

Unio radiata LAMARCK, An. sans. Vert., VI, 1819, p. 73.

Lampsilis radiata STIMPSON, N. Eng. Shells, 1851, p. 13.

Unio radiatus SPENGLER, Skriv. Nat. Selsk., V, 1792, p. 3; III, 1793, p. 62.—CONRAD, Monog., II, 1836, p. 24, pl. x, fig. 2.—GOULD, Inv. of Mass., 1841, p. 110, fig. 73; 1870, p. 170, fig. 474.—KUSTER, Conch. Cab. Unio., 1852, p. 29, pl. v, fig. 1.—REEVE, Conch. Icon., XVI, 1865, p. 27, pl. XXVII, fig. 139.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 87, fig. 182.

Margarita (Unio) radiatus LEA, Syn., 1836, p. 25; 1838, p. 19.

Margaron (Unio) radiatus LEA, Syn., 1852, p. 29; 1870, p. 44.

Lampsilis radiatus SIMPSON, Syn., 1900, p. 535.

Unio pictorum tenuis Indiæ, etc.—CHEMNITZ, Conch. Cab., 1788, p. 23, pl. II, fig. 7.

Unio virginiana LAMARCK, An. sans. Vert., VI, 1819, p. 79.—DELESSERT, Rec. Coq. Lam., 1841, pl. XII, fig. 4.

Unio lineata VALENCIENNES, Enc. Meth., II, 1827, p. 151, pl. CCXLVIII, fig. 5.

Unio elongata GOODRICH, Ill. Nat. Hist., II, 1829, p. 523, fig.

Unio tenebrosus CONRAD, New F. W. Shells, 1834, p. 42, pl. VII, fig. 1; p. 72.—CHENU, Bib. Conch., 1st ser., III, 1845, pl. II, fig. 5.

Unio melinus CONRAD, Monog., XI, 1838, p. 101, pl. LV, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVII, fig. 467.

Unio mellinus PÆTEL, Conch. Sam., III, 1890, p. 159.

Unio boydianus LEA, Pr. Am. Phil. Soc., I, 1840, p. 286; Tr. Am. Phil. Soc., VIII, 1843, p. 216, pl. XVI, fig. 32; Obs., III, 1842, p. 54, pl. XVI, fig. 32.—CHENU, Ill. Conch., 1858, pl. XXXII, figs. 2, 2*a*, 2*b*.

Margaron (Unio) boydianus LEA, Syn., 1852, p. 38; 1870, p. 62.

Unio crassus KUSTER, Conch. Cab. Unio, 1854, p. 113, pl. XXXI, fig. 5.

Mya oblongata WOOD, Index Test., 1856, p. 199, pl. 1; Supplement, fig. 2.

Unio obliquiradiatus REEVE, Conch. Icon., XVI, 1865, pl. XXIX, fig. 151.

St. Lawrence drainage; Manitoba; Atlantic region south to North Carolina.

Type locality, Virginia.

Gould reports *L. radiata* from the north shore of Lake Superior, and there is a shell in the U. S. National Museum from the northwest boundary of Wisconsin, which is probably this species.

Var. *conspicua* (Lea).

Shell, subsolid, somewhat rhomboid and elongate, subinflated; beaks rather full; epidermis decidedly concentrically wrinkled, yellowish to greenish-brown, faintly rayed; nacre straw-colored, buff, salmon or reddish.

Length 115, height 67, diam. 40 mm.

North Carolina and Southern Virginia.

Type locality, Yadkin River, Salisbury, N. C.

Unio conspicuus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 156; Jl. Ac. N. Sci. Phila., VIII, 1874 ,p. 34, pl. XI, fig. 31; Obs., XIII, 1874, p. 38, pl. XI, fig. 31.

Lampsilis radiatus var. *conspicuus* SIMPSON, Syn., 1900, p. 536.

A very abundant species distributed throughout nearly the entire Atlantic drainage. It varies greatly in size, form, degree of inflation, and solidity, and sometimes approaches so near to *luteola* that it is well-nigh impossible to separate the two. The texture of the two species is different, the *radiata* generally having a somewhat roughened epidermis, while that of *luteola* is usually smooth and bright. The nacre of the latter species is white, of a fine, porcellaneous texture, while that of *radiata* is dull and sometimes almost lurid. The variety *conspicua* is quite different from the ordinary manifestation of the species, being solider, more rhomboid and inflated than most specimens of *radiata,* but there are intermediates, which seem to fully connect the two. I have only seen male shells of the variety.

LAMPSILIS HYDIANA (Lea).

Shell of moderate size, normally subsolid but sometimes rather thin, long elliptical, ordinarily much inflated; beaks full and high, their sculpture delicate, consisting of faint, somewhat corrugated double loops, the hinder open behind; surface smooth and shining, sometimes faintly concentrically sculp-

tured, greenish, waxy-yellow, beautifully and boldly rayed with green. In some cases the rays are broad and very distinct, in others they are split into numerous fine rays with a wider ray of the ground color between them. Occasional shells are scarcely rayed at all. Left valve bearing two sharp, sometimes slightly compressed pseudocardinals, and often having a small anterior lamellar third tooth near the edge of the shell; right valve with two pseudocardinals, the lower the larger; laterals curved, one in the right valve and two in the left; anterior muscle scars well marked; posterior scars faint; nacre generally rich silvery, though sometimes bluish and lurid brown in the cavity of the beaks. The male shell is somewhat pointed behind about midway up from the base; that of the female is rather blunt behind and decidedly swollen at the post-base.

Length (male) 60, height 35, diam. 25 mm.

Length (female) 57, height 38, diam. 27 mm.

Eastern half of Texas; Indian Territory; Arkansas; east to Alabama.

Type locality, Teche River, Ia.

Unio hydianus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 14, pl. VI, fig. 14; Obs., II, 1838, p. 14, pl. VI, fig. 14.—HANLEY, Biv. Shells, 1843, p. 192, pl. XXIII, fig. 6.—KUSTER, Conch. Cab. Unio., 1861, p. 201, pl. LXVII, fig. 2.—CHENU, Ill. Conch., 1858, pl. XVII, fig. 3, *3a*, *3b*; pl. XXIV, figs. 7, *7a*, *7b*.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVII, fig. 203.

Margarita (Unio) hydianus LEA, Syn., 1836, p. 25; 1838, p. 19.

Margaron (Unio) hydianus LEA, Syn., 1852, p. 28; 1870, p. 44.

Lampsilis hydianus SIMPSON, Syn., 1900, p. 536.

Unio placitus LEA, Pr. Am. Phil. Soc. ,V, 1852, p. 252; Tr. Am. Phil. Soc., 1852, p. 279, pl. XXIII, fig. 38; Obs., V,1852, p. 35, pl. XXIII, fig. 38.—KUSTER, Conch. Cab. Unio., 1861, p. 262, pl. LXXXVIII, fig. 2.

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

A beautiful shell, which is often confounded with *L. luteola*. It is smaller than the typical form of that species, the epidermis has a more waxy texture, it is generally more inflated and

the pattern of rays is bolder, more distinct, and more brilliant. It seems to replace *L. luteola* in the waters of the southwestern states. The nacre of *L. hydiana* is scarcely thickened in front, while in *luteola* it generally becomes thicker anteriorly.

LAMPSILIS APPROXIMA (Lea).

Shell but slightly thickened, long elliptical or long obovate, somewhat inflated; the surface faintly concentrically sculptured, but shining; beaks not very high or full; epidermis straw-color, often tawny in the region of the beaks, usually rayless except at the posterior slope, and when there are rays they are always faint; right valve with two pseudocardinals, the upper somewhat compressed and smaller; left valve with two pseudocardinals; there is one lamellar, curved lateral in the right valve and two in the left; beak cavities rather shallow; anterior muscle scars well impressed; posterior scars large but rather faint; nacre whitish or bluish, sometimes dirty, pale purplish, usually with lurid, bronzy blotches in the cavity of the shell, very slightly thickened in front. Male shell sometimes feebly biangulate behind, but not pointed; female shell considerably swollen at the post-base and rounded or sub-truncate behind.

Length (male) 80, height 47, diam. 26 mm.

Length (female) 70, height 57, diam. 26 mm.

Southern Louisiana; southern Alabama.

Type locality, Red River, Alexandria, La.

Unio approximus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164; Tr. Am. Phil. Soc., X, 1848, p. 74, pl. v, fig. 13; Obs., IV, 1848, p. 48, pl. v, fig. 13.

Margaron (Unio) approximus LEA, Syn., 1852, p. 28; 1870, p. 44.

Lampsilis approximus SIMPSON, Syn., 1900, p. 537.

Unio affinis LEA, Pr. Am. Phil. Soc., V, 1852, p. 251; Tr. Am. Phil. Soc., 1855, p. 271, pl. XIX, fig. 26; Obs., V, 1852, p. 27, pl. XIX, fig. 26.

Margaron (Unio) affinis LEA, Syn., 1852, p. 27; 1870, p. 42.

Lampsilis affinis SIMPSON, Syn., 1900, p. 537.

Extremely close to *L. hydiana* on the one hand and *L. claibornensis* on the other. It is a rather larger, less inflated species than *hydiana;* it is generally thinner and less rayed than that species. The ground color is more yellowish or tawny than in *hydiana* and the nacre duller and more often blotched. All the specimens I have seen have the beaks so badly eroded that no sculpture is visible. The *Unio affinis* of Lea is shaped a little differently from *approxima* and in the Synopsis I considered it a distinct species. Since writing that I have seen additional material that leads me to regard them both as the same.

LAMPSILIS CONTRARIA (Conrad).

Shell rather small; valves convex, solid, elliptical; beaks not prominent, the sculpture not seen; surface generally smooth and shining; epidermis deep ochraceous, becoming lighter at the border of the shell, with linear, radiating wrinkles in the umbonal region; hinge line regularly curved; pseudocardinals triangular, solid, low, laterals reversed in the type, but normal in specimens seen; nacre pale flesh-color; muscle scars well impressed, small. The male shell is elliptical or elliptic oval, having a rounded point just above the posterior base; the female is nearly regularly rounded and wider behind; marsupial swelling rounded and but slightly produced.

Length (male) 50, height 32, diam. 25 mm.

Length (female) 52, height 35, diam. 25 mm.

Type locality, Ogeechee River, Georgia. Also Pine Barren Creek, Escambia county, Florida.

Unio contrarius CONRAD, Pr. Ac. Nat. Sci. Phila., IV, 1849, p. 153; Jl. Ac. Nat. Sci. Phila., I, 1850, p. 276, pl. XXXVII, fig. 7.

Lampsilis contrarius SIMPSON, Syn., 1900, p. 537.

A species close to *L. claibornensis* and possibly only a variety of it. It is considerably smaller than that species, is more evenly convex, the posterior point of the male shell is nearer the base than is that of *L. claibornensis,* the pseudocardinals are shorter and more stumpy. Since the Synopsis was written I have examined shells from Pine Barren Creek, Escambia

County, Florida, which agree fairly well with Conrad's description and figure of *Unio contrarius*, and which I cannot satisfactorily refer to any other species.

LAMPSILIS CLAIBORNENSIS (Lea).

Shell solid, elliptical, greatly inflated when old, beaks scarcely elevated or inflated, their sculpture not seen; surface slightly concentrically sculptured but rather smooth, varying from greenish straw-color to tawny-brown, sometimes having a few faint rays on the posterior slope; the rest of the shell is generally rayless; lunule scarcely developed; left valve with two rather small pseudocardinals and two strong laterals, the lower the larger; right valve with two pseudocardinals, the upper the smaller and one strong lateral; muscle scars well impressed; beak cavities moderately deep; nacre bright silvery, sometimes pink or salmon-tinted, a little thicker in front. Male shell somewhat pointed behind about midway up from the base; female shell but slightly produced in the post-basal region, generally nearly rounded behind.

Length 70, height 45, diam. 35 mm.

Length 70, height 50, diam. 42 mm.

Gulf drainage of the United States, from the Flint to the Pearl River.

Type locality, Alabama River, Claiborne, Ala.

Unio claibornensis LEA, Tr. Am. Phil. Soc., VI, 1838, p. 105, pl. XXIV, fig. 115; Obs., II, 1838, p. 105, pl. XXIV, fig. 115.—TROSCHEL, Arch. für Naturg., V, 1839, pl. II, p. 237.—HANLEY, Biv. Shells, 1843, p. 192, pl. XXI, fig. 26.—CHENU, Ill. Conch., 1858, pl. XXIII, figs. 3, 3*a*, 3*b*.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXX, fig. 357.

Margarita (Unio) claibornensis LEA, Syn., 1838, p. 19.

Margaron (Unio) claibornensis LEA, Syn., 1852, p. 28; 1870, p. 44.

Lampsilis claibornensis SIMPSON, Syn., 1900, p. 537.

Unio obtusus LEA, Pr. Am. Phil. Soc., I, 1840, p. 287; Tr. Am. Phil. Soc., VIII, 1843, p. 201, pl. XI, fig. 13; Obs., III, 1842, p. 30, pl. XI, fig. 13.—CHENU, Ill. Conch. 1858, pl. XXXI, figs. 2, 2*a*, 2*b*.—REEVE, Conch. Icon., XVI, 1865, pl. XXVI, fig. 129.

Margaron (Unio) obtusus LEA, Syn., 1852, p. 39; 1870, p. 62.
Unio pallescens LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164; Tr. Am. Phil. Soc., X, 1848, p. 79, pl. VII, fig. 20; Obs., IV, 1848, p. 79, pl. VII, fig. 20.
Margaron (Unio) pallescens LEA, Syn., 1852, p. 27; 1870, p. 43.

A solider shell than either *Lampsilis hydiana* or *L. approxima*. It is more inflated than the latter and is never rayed like the former. There are individual specimens, which are intermediate and seem to more or less connect the three species.

LAMPSILIS PERPASTA (Lea).

Shell obovate, solid, greatly inflated, with moderate beaks and a rounded posterior ridge, which is somewhat double and ends in a faint, narrow, biangulation at a considerable distance above the base line of the shell; ligament brown, carried forward under the beaks and ending in front in a small lunule; growth lines rather rude, irregular; epidermis shining tawny, brownish at the beaks, rayless; left valve with two stumpy pseudocardinals, the hinder opposite the beak, and two remote, heavy laterals, the lower the solider; hinge line rounded in the middle; right valve with one principal pseudocardinal and a smaller one in front and behind it; beak cavities moderately excavated; muscle scars deep, smooth; nacre whitish, tinted with lurid purple behind.

Length 50, height 35, diam. 28 mm.

Length 55, height 42. diam. 35 mm.

Type locality, Coosa River, Alabama. Also Swamp Creek, Georgia.

Unio perpastus LEA, Pr. Ac. N. Sci., Phila., V, 1861, p. 60; Jl. Ac. N. Sci. Phila., V, 1862, p. 69, pl. VII, fig. 219; Obs., VIII, 1862, p. 73, pl. VII, fig. 219.
Margaron (Unio) perpastus LEA, Syn., 1870, p. 43.
Lampsilis perpastus SIMPSON, Syn., 1900, p. 532.

Since writing the Synopsis I have had an opportunity of seeing quite a number of shells of this rare species. In that work I placed it in the *ventricosa* group, but I am now in-

clined to believe that it should go in the *luteola* group, near *L. claibornensis*. The epidermis is tawny and of a somewhat waxy appearance; the shell is short, solid, and, in old specimens, much inflated.

LAMPSILIS PORPHYREA (Lea).

Shell elliptical, much inflated, solid, slightly gaping at the anterior base; beaks in the specimens seen apparently low, but badly eroded; growth lines irregular; surface rather smooth, but dull colored, tawny, becoming brownish near the beaks; left valve with two rather small, solid pseudocardinals and two short, heavy, remote laterals; right valve with three pseudocardinals, the middle one the largest, the hinder one small, and one strong lateral; beak cavities shallow; muscle scars well impressed; nacre deep purple or dirty white, blotched in the cavity of the shell.

Length 56, height 46, diam. 26 mm.

Length 46, height 27, diam. 23 mm.

Cahawba and Coosa Rivers, Alabama.

Type locality, Coosa River, Ala.

Unio porphyreus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 60; Jl. Ac. N. Sci. Phila., V, 1862, p. 80, pl. x, fig. 228; Obs., VIII, 1862, p. 84, pl. x, fig. 228.

Margaron (Unio) porphyreus LEA, Syn., 1870, p. 41.

Lampsilis porphyreus SIMPSON, Syn., 1900, p. 538.

Two shells are in the Lea collection, the larger of which is distorted at the anterior base and has a dirty white, blotched nacre. One additional shell with purple nacre has been examined, which belongs to the Aldrich collection. The species is smaller than *L. claibornensis*, is more solid, more evenly elliptical and is slightly biangulate behind in the three specimens examined, which are probably males.

LAMPSILIS STRAMINEA (Conrad).

Shell long elliptical or long obovate, not greatly inflated, subsolid, with a slight posterior ridge; beaks not full or high, their sculpture not seen; surface usually sculptured

with strong concentric ridges, rather shining, buff, straw-colored or greenish-yellow, often having faint rays on the posterior slope, and sometimes a few faint ones on the body of the shell; each valve having two pseudocardinals, the upper one in the right being compressed and smaller; left valve with two lamellar laterals; right valve with one lateral; beak cavities moderately deep; anterior muscle scars impressed; posterior scars faint; nacre bluish-white, rather dull, often with a dark spot in the region of the beak cavities, scarcely thickened in front. Male shell pointed behind, about midway up from the base; female shell often much produced at the posterior base, rounded or subtruncate behind.

Length (male) 80, height 50, diam. 30 mm.

Length (female) 70, height 50, diam. 30 mm.

Southern Alabama, southern Mississippi.

Type locality, small streams in southern Alabama.

Unio stramineus CONRAD, Am. Jl. Sci., XXV, 1834, p. 339, pl. 1, fig. 6; Monog., X, 1838, p. 91, pl. L, fig. 1.—HANLEY, Biv. Shells, 1843, p. 209, pl. XXIII, fig. 45.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIX, fig. 217; 1868, pl. LXXX, fig. 422.

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

Margaron (Unio) stramineus LEA, Syn., 1852, p. 28; 1870, p. 35.

Lampsilis stramineus SIMPSON, Syn., 1900, p. 538.

The shell is of rather light structure and the concentric sculpture is almost always well developed. Frequently the concentric ridges are very strong and regular.

LAMPSILIS BRACTEATA (Gould).

Shell elliptical, thin to subsolid, somewhat inflated, with a scarcely perceptible rounded post-ridge; beaks not elevated, sculptured with rather fine, distinctly doubly-looped ridges; growth lines irregular; surface either smooth or irregularly sulcate, somewhat shining, greenish straw-colored with numerous irregular, wavy, narrow and broad rays; left valve

with two equal, delicate pseudocardinals and two curved, lamellar laterals; right valve with two pseudocardinals, the lower the larger, and one lateral; beak cavities not deep; nacre bluish, white or salmon-tinted, brilliant, scarcely thickened in front. The male shell is somewhat oblong, and is not narrowed at the anterior or posterior ends, the hinder end rounded and scarcely pointed; the female shell is somewhat rounded behind and has an evenly curved marsupial swelling.

Length (male) 53, height 32, diam. 18 mm.

Length (male) 58, height 35, diam. 22 mm.

Length (female) 50, height 33, diam. 21 mm.

Llanos, Guadalupe, and Colorado Rivers, Texas.

Type locality, Llanos River, Texas.

Unio bracteatus GOULD, Pr. Bost. Soc. N. Hist., V, 1855, p. 288.

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

Lampsilis bracteatus SIMPSON, Syn., 1900, p. 543.

I had only seen a single specimen of this species when the Synopsis was written, a male shell presented to Dr. Lea by Dr. Gould, and I was inclined to believe that it was a rather delicate member of the *ligamentina group*. A considerable amount of material received since then including a number of female shells leads me to believe that it belongs nearer to *L. powellii* and *recviana*. It is a shorter shell than either of these, and the male is more evenly oblong.

LAMPSILIS REEVIANA (Lea).

Shell subsolid, but quite thin and inclined to crack at the edges, long, elliptical or long obovate, only moderately inflated; beaks not high or full, their sculpture not seen; surface smooth and shining, yellowish-green or greenish-yellow, with numerous broken, wavy green rays. These rays are often wide and narrow alternately and are so broken as to have occasional concentric bands of the lighter color; hinge with small and sometimes imperfectly developed pseudocardinals, two in the left valve and one in the right; laterals small and short, remote from pseudocardinals and separated from them by a nar-

row, rounded hinge plate; beak cavities not deep; muscle scars shallow; nacre bluish, a little thicker in front, generally dark in the cavity of the shell. Male shell bluntly pointed or subbiangular behind midway up from the base; female shell considerably produced at the post-basal region, subtruncate or rounded behind.

Length (male) 70, height 40, diam. 25 mm.

Length (female) 67, height 42, diam. 26 mm.

Louisiana; Texas; Arkansas.

Type locality, Alexandria, La.

Unio reevianus LEA, Tr. Am. Phil. Soc., X, 1852, p. 272, pl. XX, fig. 28; Obs., V, 1852, p. 28, pl. XX, fig. 28.—KUSTER, Conch. Cab. Unio., 1861, p. 247, pl. LXXXIII, fig. 2.

Margaron (Unio) reevianus LEA, Syn., 1852, p. 28; 1870, p. 44.

Lampsilis reevianus SIMPSON, Syn., 1900, p. 538.

The relationships of this species are a little doubtful, but the character and texture of the nacre are much like those of *L. radiata*. It has characters like some of the species of the *ligamentina* group. Its exceedingly small, often feebly developed pseudocardinals and remote laterals and the peculiar color pattern are good characters, as well as the color of its nacre.

LAMPSILIS POWELLII (Lea).

Shell long, elliptical or long obovate, subsolid to rather thin, subinflated, narrow and rounded in front, with a few irregular growth lines; beaks only moderately full, their sculpture not observed; surface tawny, rayless in all the examples seen; hinge line quite evenly curved; left valve with two rather small, sharp pseudocardinals and two short, remote laterals; right valve with two pseudocardinals, the upper the smaller, and a single rather long lateral; beak cavities moderately deep; anterior muscle scars impressed, posterior scars large, indistinct; nacre dirty whitish, becoming dark and lurid in the center of the valves, scarcely thickened in front. Male shell feebly biangulate behind midway up from the base; female shell somewhat produced at the posterior base, wide and rounded behind.

Length (male) 80, height 47, diam. 28 mm.

Length (female) 75, height 48, diam. 28 mm.

Salina and Clinton, Arkansas; Guadalupe River, Texas; Spring River, Kansas (Cragin).

Type locality, Saline River, Ark.

Unio powellii LEA, Pr. Am. Phil. Soc., V, 1852, p. 252; Tr. Am. Phil. Soc., X, 1853, p. 270, pl. XIX, fig. 25; Obs., V, 1852, p. 26, pl. XIX, fig. 25.—MUSGRAVE, Phot. Conch., 1863, pl. II, fig. 8.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXX, fig. 359.

Margaron (Unio) powellii LEA, Syn., 1852, p. 28, 1870, p. 44.

Lampsilis powellii SIMPSON, Syn., 1900, p. 538.

This species is close to *L. recviana* and is perhaps only a variety of it. It is a little solider than that species, especially at the edges of the shell, is rayless, and has a somewhat different texture.

Group of *Lampsilis orbiculata.*

Shell elliptical, subquadrate or ovate, very solid, more or less inflated, slightly gaping at the anterior base; beaks well in front, large, full and high, their sculpture consisting of faint, scarcely looped ridges; epidermis tawny to dark, smooth, scarcely showing rays; lunule deep and distinct, passing under the beaks; hinge and teeth strong; there are two pseudocardinals in the left valve and two to three in the right; two laterals in the left valve and one in the right; muscle scars well impressed; nacre bright. Animal with large gills, which are rounded below, inner much the larger, united their whole length to the abdominal sac; palpi large, thick, oblique, oval; branchial opening very large; anal opening rather large, both having many small papillæ.

LAMPSILIS ORBICULATA (Hildreth).

Shell somewhat inflated with a well-marked posterior ridge, elliptical, solid, gaping at the anterior base; beaks moderately elevated, with very faint sculpture; lunule elongated, surface generally having wide, low, concentric ridges, the rest periods

often marked by a sulcus, tawny to pale, dirty olive, sometimes feebly rayed; ligament large and full; left valve with two triangular pseudocardinals and two strong laterals; right valve with two pseudocardinals, the hinder triangular and large, the anterior small, there is sometimes a third small pseudocardinal behind the other two, there is one strong high lateral; posterior muscle scars large, rather deep; anterior scars very deep and rough; beak cavities deep; nacre white or salmon-tinted. The male is pointed behind about midway up from the base; the female shell has a well-developed post-basal swelling.

Length (male) 85, height 70, diam. 34 mm.

Length (female) 75, height 63, diam. 35 mm.

Ohio and Cumberland Rivers; west to the Mississippi River. Type locality, Muskingum River, Ohio.

Unio orbiculatus HILDRETH, Am. Jl. Sci., XIV, 1828, p. 284.—HANLEY, Biv. Shells, 1843, p. 192, pl. XXI, fig. 2.—KUSTER, Conch. Cab., 1861, p. 216, pl. LXXI, figs. 3, 4.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLIV, fig. 239.

Margarita (Unio) orbiculatus LEA, Syn., 1836, p. 25; 1838, p. 19.

Margaron (Unio) orbiculatus LEA, Syn., 1852, p. 28; 1870, p. 43.

Lampsilis orbiculatus SIMPSON, Syn., 1900, p. 540.

Lampsilis orbiculata ORTMANN, Ann. Car. Mus., VIII, 1912, p. 353.

Unio abruptus SAY, Am. Conch., No. II, 1831, pl. XVII,—CHENU, Bib. Conch., 1st ser., III, 1845, p. 24, pl. VI, figs. 1, 1*a*, 1*b*.

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

Unio crassus CONRAD, Monog., IV, 1836, p. 34, pl. XVI.

Lighter colored, less inflated, and more humped than *L. higginsii*, the latter having much the form of *Obovaria ellipsis* Lea. It is lighter colored and more humped, it has a stronger posterior ridge and is less convex than the form I have called *higginsii* var. *grandis*. The young shell of *orbiculata* is more elongated and the beaks are less elevated than is the case in *L.*

higginsii. Nevertheless the three forms are very puzzling and there are occasional specimens, which cannot be assigned with much certainty to any of the three.

LAMPSILIS HIGGINSII (Lea).

Shell solid, inflated, gaping at the anterior base, oval, elliptical or subquadrate with a feeble posterior ridge, with full, high beaks placed well forward, whose sculpture consists of very feeble, scarcely looped ridges, in front of which is a well-developed lunule; ligament large; surface with occasional irregular growth lines but generally smooth and somewhat shining; rest lines dark and usually well marked; color, olive with occasional faint rays; left valve with two triangular, short pseudocardinals and two heavy laterals; right valve with two, often three pseudocardinals, the middle one the largest, and one lateral, often having a vestige of another below it; muscle scars deep; beak cavities moderate; nacre silvery, flesh-color or salmon-tinted. The male shell is bluntly pointed behind about midway up from the base; the female is truncated behind and has a very much-produced marsupial swelling at the extreme posterior base.

Length (male) 75, height 60, diam. 42 mm.

Length (female) 70, height 60, diam. 40 mm.

Ohio River, west to Iowa, and southwest to Kansas.

Type locality, Muscatine, Ia.

Unio higginsii LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 84; Jl. Ac. N. Sci. Phila., V, 1862, p. 188, pl. XXIV, fig. 258; Obs., IX, 1863, p. 10, pl. XXIV, fig. 258.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXII, fig. 431.

Margaron (Unio) higginsii LEA, Syn., 1870, p. 41.

Lampsilis higginsii SIMPSON, Syn., 1900, p. 540.

Var. *grandis* n. v.

Shell higher and longer than the type, less inflated, that of the female more produced at the posterior base, color pattern generally more brownish, the umbonal region umber-colored.

Length (male) 98, height 70, diam. 42 mm.
Length (female) 76, height 63, diam. 40 mm.
Illinois; Iowa; Kansas; Missouri? Ohio River?

This is a very puzzling form, the type seeming to connect with the variety, and there are specimens, which seem to stand between the variety and *orbiculata*. I have seen perhaps a dozen or more specimens, which are fairly typical, and in these the shell is smaller and more inflated than in the variety, and the epidermis is olive and not darker on the beaks as it is in the form I have called *grandis*. I found the variety fairly abundant in the Illinois River near Utica; the typical form, which is a rather rare shell, seems to be most abundant in the Mississippi River in the vicinity of Davenport, Iowa.

Group of *Lampsilis ligamentina*.

Shell solid, short, evenly elliptical, not greatly inflated, with a yellowish-green epidermis, with broad, usually broken, dark green rays; beaks not prominent, sculpture fine, restricted in area; pseudocardinals rather small, stumpy; nacre silvery or rarely pinkish. The female shell is not greatly swollen in the post-basal region.

LAMPSILIS LIGAMENTINA (Lamarck).

Shell solid, almost regularly long elliptical, rounded in front, rounded slightly or pointed behind about midway up from the base of the shell, young and adult specimens moderately inflated, old specimens decidedly swollen, having a low, rounded posterior ridge, slightly gaping at the anterior base; old shells having a well-developed lunule running through under the beaks; beaks scarcely inflated, low, their sculpture consisting of very faint, doubly-looped, irregular ridges; ligament large, long; surface nearly smooth or marked with rude, irregular, low, concentric ridges, tawny to pale greenish with broad, rather faint and somewhat broken rays; left valve with two small pseudocardinals and two remote, rather small laterals; right valve with two pseudocardinals, the anterior smaller, and sometimes a small posterior third tooth, with one high

lateral; beak cavities not deep; muscle scars large, well impressed and smooth; nacre white or pink, much thickened in front in old shells; female shells very slightly produced at posterior base.

Length 140, height 90, diam. 58 mm.

Mississippi River drainage generally; southern Michigan; western New York; Manitoba; Ontario.

Type locality, Ohio River.

Unio crassus SAY, Nich. Encyc., II, 1817, pl. I, fig. 8.—HILDRETH, Am. Jl. Sci., XIV, 1828, p. 278, fig. 1.—SOWERBY, Conch. Icon., XVI, 1866, pl. XL, fig. 220.

Margarita (Unio) crassus LEA, Syn., 1836, pl. 24; 1838, p. 19.

Mya crassa EATON, Zool. Text-Book, 1826, p. 217.

Unio ligamentina LAMARCK, An. sans Vert., VI, 1819, p. 72.

Unio ligamentinus KUSTER, Conch. Cab. Unio, 1852, p. 23, pl. III, fig. 3.—CALL, Tr. Ac. Sci. St. Louis, VII, p. 22, pl. XXI.

Margaron (Unio) ligamentinus LEA, Syn., 1852, p. 28; 1870, p. 43.

Lampsilis ligamentinus BAKER, Moll. Chicago, Pt. I, 1898, p. 108, pl. XVI,—SMITH, Bull. U. S. F. Com., 1899, p. 291, pl. LXXIX.—SIMPSON, Syn., 1900, p. 539.

Nephronajas ligamentina ORTMANN, Ann. Car. Mus., VIII, 1912, p. 325.

Unio ellipticus BARNES, Am. Jl. Sci., VI, 1823, p. 259, pl. XIII, fig. 19 (outline).

Mya elliptica EATON, Zool. Text-Book, 1826, p. 219.

Unio carinatus BARNES, Am. Jl. Sci., VI, 1823, p. 259, pl. XI, fig. 10.

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

Unio ellipsarius SAY, Am. Conch. VI, 1834.

Unio fasciatus SAY, Am. Conch., VI, 1834.—CONRAD, Monog., 1835, p. 3, pl. I.—POTIEZ and MICHAUD, Gall. Moll., 1844, p. 153, pl. LVIII, fig. 5.—KUSTER, Conch. Cab., 1852, p. 31, pl. V, fig. 3.

Mya gravis WOOD, Ind. Test., (Hanley) 1856, p. 199, pl. I, fig. 6.

Unio gravis PÆTEL, Conch. Sam., III, 1890, p. 154.
Unio luteolus SOWERBY, Conch. Icon., XVI, 1867, pl. LVIII, fig. 293*a*.
Unio delodontus SOWERBY, Conch. Icon., XVI, 1867, pl. LVII, fig. 288.
Unio crassidens SOWERBY, Conch. Icon., XVI, 1868, pl. LXII, fig. 312.
Unio pictus SOWERBY, Conch. Icon., XVI, 1868, pl. LXII, fig. 313.
Unio venustus SOWERBY, Conch. Icon., XVI, 1868, pl. LXIV, fig. 326.
Unio upsoni MARSH, Conch., Ex. 1, 1887, p. 51.
Unio pinguis LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 84; Jl. Ac. N. Sci. Phila., IV, 1858, p. 78, pl. XV, fig. 58; Obs., VI, 1858, p. 78, pl. XV, fig. 58.
Margaron (Unio) pinguis LEA, Syn., 1870, p. 44.
Lampsilis pinguis SIMPSON, Syn. 1900, p. 540.

After again carefully comparing the type of Lea's *Unio pinguis*, the only specimen I have ever seen, I am quite certain that it is a somewhat peculiar shell of *L. ligamentina*, in which the hinge line is a little injured, so that it has become sinuous. The following is a description of the type:

Shell irregularly obovate, rather solid, inflated, with a low, rounded posterior ridge; ligament large and long, brownish; beaks rather full, turned slightly forward; in front of and between them there is a wide, deep lunule; surface having occasional, irregular, low, concentric ridges, yellowish-green with a few pale rays; hinge line decidedly sinous; left valve with two sharp, somewhat ragged pseudocardinals and two lamellar laterals; right valve with two opposite pseudocardinals, the upper the smaller, and one high lateral; beak cavities rather deep; anterior scars deep, separate; posterior scars shallow; nacre whitish, iridescent behind with lurid blotches in the cavity of the shell, scarcely thickened before.

Length 70, height 48, diam. 33 mm.

The shell gapes decidedly at the anterior base, and the depressed lunule makes a deep impression on the dorsal outline.

Var. *gibba* Simpson.

Shell considerably shorter and more solid than the type, with a decided, curved posterior ridge, the dorsal region much rounded or humped; surface having strong, low, concentric ridges; muscle scars smaller than in the typical shell; female shell somewhat produced at post-base.

Length 95, height 70, diam. 40 mm.

Ohio River, and southward.

Unio crassus Sowerby, Conch. Icon., XVI, 1868, pl. xcv, fig. 520.

Lampsilis ligamentinus var. *gibbus* Simpson, Syn., 1900, p. 540.

Var. *nigrescens* n. v.

Shell much elongated, subelliptical to subrhomboid; epidermis dark brown to blackish, almost or quite destitute of rays.

Length 115, height 61.5, diam. 44 mm.

Length 113, height 60, diam. 38 mm.

Allegheny County, Pennsylvania; Mississippi River, Lee County, Iowa; Kankakee River, Illinois.

A greatly elongated form with very dark, almost or quite rayless epidermis. It seems to be sufficiently distinct to be worthy of a varietal name.

Lampsilis ligamentina is an abundant, widely distributed and variable form, generally of large size, and often quite ponderous. There are, however, occasional shells of considerable size and light structure. South of the Ohio River and west into southern Missouri and Arkansas the type is generally replaced by the variety *gibba*, which in many cases is distinct enough to be entitled to specific rank, but the two forms are connected by many intermediates. Some specimens of the variety approach *L. orbiculata* in form, but it is a rougher shell, greener colored, and usually has strong, low, concentric ridges.

The name *crassus* was applied to this species by Say before that of Lamarck was given to it, but Retzius had previously used the same name for an European *Unio*.

LAMPSILIS TÆNIATA (Conrad).

Shell moderately convex, long elliptical, rather solid, with scarcely elevated beaks, which are sculptured with distinct, somewhat corrugated, doubly-looped ridges; sometimes these ridges are greatly broken up; surface having more or less scattered growth lines, often concentrically sculptured in front, greenish-yellow, with broad, distinct, broken rays; lunule very narrow; left valve with two equal-sized, prominent, slender pseudocardinals and two compressed, small laterals; right valve with one elevated pseudocardinal, sometimes with a vestigial one above it, and one compressed lateral; beak cavities shallow; muscle scars well impressed; nacre bluish-white. Male shell bluntly pointed or feebly biangulate behind about half way up from the base; female shell with a moderate, wide marsupial swelling and ending behind in a blunt point two-thirds of the way up from the base.

Length (male) 80, height 60, diam. 30 mm.

Length (female) 70, height 45, diam. 26 mm.

Tennessee and Cumberland River systems.

Type locality, Flint River, Morgan Co., Ala.

Unio tæniatus CONRAD, New F. W. Shells, 1834, pp. 26, 72, pl. IV, fig. 2.—KUSTER, Conch. Cab. Unio, 1862, p. 271, pl. XCI, fig. 4.

Margarita (Unio) tæniatus LEA, Syn., 1836, p. 24; 1838, p. 19.

Unio taniatus PÆTEL, Conch. Sam., III, 1890, p. 169.

Lampsilis tæniatus SIMPSON, Syn., 1900, p. 541.

Unio menkianus LEA, Tr. Am. Phil. Soc., V, 1836, p. 76, pl. XIX, fig. 59; Obs., II, 1838, p. 76, pl. XIX, fig. 59.—HANLEY, Biv. Shells, 1843, p. 191, pl. XXIII, fig. 4.—CHENU, Ill. Conch., 1858, pl. XIX, figs. 4, 4*a*, 4*b*.—KUSTER, Conch. Cab. Unio, 1861, p. 245, pl. LXXXII, fig. 3.—REEVE, Conch. Icon., XVI, 1865, pl. XXVIII, fig. 140.

Margarita (Unio) menkianus LEA, Syn., 1838, p. 19.

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

Unio pulcher LEA, Tr. Am. Phil. Soc., VI, 1838, p. 6, pl. III, fig. 6; Obs., II, 1838, p. 6, pl. III, fig. 6.—HANLEY, Biv. Shells, 1843, p. 193, pl. XXIII, fig. 7.—CHENU, Ill. Conch., 1858, pl. XVII, figs. 2, 2*a*, 2*b*.—KUSTER, Conch. Cab. Unio, 1861, p. 193, pl. LXI, fig. 5.

Margarita (Unio) pulcher LEA, Syn., 1836, p. 25; 1838, p. 19.

Margaron (Unio) pulcher LEA, Syn., 1852, p. 28; 1870, p. 44.

Unio interruptus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 15, pl. VI, fig. 15; Obs., II, 1838, p. 15, pl. VI, fig. 15.—HANLEY, Biv. Shells, 1843, p. 191, pl. XXI, fig. 28.—CHENU, Ill. Conch., 1858, pl. XVII, figs. 4, 4*a*, 4*b*.

Margarita (Unio) interruptus LEA, Syn., 1836, p. 24; 1838, p. 19.

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

Unio latiradiatus CONRAD, Monog., XI, 1838, p. 96, pl. LIII.—KUSTER, Conch. Cab. Unio, 1861, p. 208, pl. LXIX, fig. 3.

Unio tennesseensis LEA, Pr. Am. Phil. Soc., I, 1840, p. 288; Tr. Am. Phil. Soc., VIII, 1843, p. 199, pl. X, fig. 11; Obs., III, 1842, p. 37, pl. X, fig. 11.—CHENU, Ill. Conch., 1858, pl. XXVII, figs. 1, 1*a*, 1*b*.

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

Unio perdix REEVE, Conch. Icon., XVI, 1864, pl. XVIII, fig. 82.

The young shells are often brilliantly printed, and the rays are either entire or broken. Old shells become duller colored and are sometimes badly worn. The species probably lives in rapids. After a careful study of all of the above so-called species I cannot see that they possess any characters that make them worthy even of varietal names.

LAMPSILIS PICTA (Lea).

Shell elliptical or obovate, subsolid, compressed, with flattened but sharp-pointed beaks, which have irregular, corrugated, somewhat doubly-looped sculpture; posterior ridge scarcely developed; above it is a wide, shallow, radial depression end-

ing in a slight sinus; growth lines fine and rather even; surface dull to shining; pale greenish-yellow with much broken rays, forming a concentric row of square spots around the upper part of each season's growth; lunule small, narrow; let valve with two small, nearly equal, erect pseudocardinals and two delicate, straight laterals; right valve with one pseudocardinal and a minute tooth in front of and another behind it, with a single lamellar lateral; beak cavities quite shallow, with a row of small dorsal scars; muscle scars well impressed; nacre silvery or lurid. The female shell seems to differ but little from that of the male; it has a wide, slight marsupial swelling; both are rounded or feebly biangulate posteriorly.

Length 60, height 38, diam. 15 mm.

Type locality, Harpeth River, Tennessee.

Unio pictus LEA, Tr. Am. Phil. Soc., V, 1834, p. 73, pl. XI, fig. 32; Obs., I, 1834, p. 185, pl. XI, fig. 32.—HANLEY, Biv. Shells, 1843, p. 191, pl. XXIII, fig. 35.—KUSTER, Conch. Cab. Unio, 1861, p. 249, pl. LXXXIII, fig. 5.

Margarita (Unio) pictus LEA, Syn., 1836, p. 24; 1838, p. 19.

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

Lampsilis pictus SIMPSON, Syn., 1900, p. 542.

Eurynia (Micromya) picta ORTMANN, Ann. Car. Mus., VIII, 1912, p. 342.

Unio lindsleyi LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 306; Jl. Ac. N. Sci. Phila., 1860, p. 351, pl. LVIII, fig. 176; Obs., VIII, 1860, p. 33, pl. LVIII, fig. 176.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLII, fig. 233*b*.

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

Unio camelopardalis SOWERBY, Conch. Icon., XVI, 1866, pl. XLII, fig. 233*a*.

Very close to *tæniata*, and it may be only a variety of that, but it is more compressed, more evenly rounded posteriorly, and the color pattern is quite different, consisting of square blotches—broken rays—arranged in concentric rows at the beginning of each year's growth. The type, a larger shell than Lea's largest specimen, is probably in the Troost collection.

Lea's shell is perhaps not adult. *U. lindsleyi* Lea is, I believe, the same thing, but Lea's shells are older, a little solider and slightly more inflated.

LAMPSILIS CAMELOPARDILIS (Lea).

Shell long elliptical or long rhomboid, subsolid, with subinflated valves, rounded in front, with a low, rounded posterior ridge, rounded at the basal part of the posterior end and obliquely truncate above; beaks only moderately full, not elevated, their sculpture not seen; surface smooth, shining, pale greenish-yellow, with broad, broken rays, which generally form a series of distinct, square spots, one concentric row on each season's growth; left valve with two equal, rather high subcompressed pseudocardinals, the posterior one under the beak, and two short, straight laterals; right valve with a single pseudocardinal, with a vestigial tooth in front of it and another behind it, and one lateral; muscle scars well impressed; nacre bluish-white. The female shell is more evenly rounded behind and is less truncate on the upper part of the posterior end than the male. The latter is slightly rounded on the base; it has a feeble, widely rounded post-basal inflation, and is straight or faintly incurved on the base.

Length (male) 60, height 30, diam. 16 mm.

Length (female) 55, height 27, diam. 16 mm.

Tennessee and Cumberland River systems.

Type locality, Northern Alabama.

Unio camelopardilis LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 92; Jl. Ac. N. Sci. Phila., IV, 1860, p. 355, pl. LIX, fig. 180; Obs., VIII, 1860, p. 37, pl. LIX, fig. 180.

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

Lampsilis camelopardilis SIMPSON, Syn., 1900, p. 542.

Unio fucatus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 92; Jl. Ac. N. Sci. Phila., IV, 1860, p. 353, pl. LIX, fig. 178; Obs., VIII, 1860, p. 35, pl. LIX, fig. 178.

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

Close to *L. picta,* and *L. tæniata.* I have only seen a few specimens of what are probably young shells of this species. It is less elliptical than either of the other species, is more rhomboid and smoother, the epidermis is a waxy, greenish-yellow.

LAMPSILIS PUNCTATA (Lea).

Shell long obovate, generally solid, subinflated, with low, not inflated beaks, whose sculpture is unknown; posterior ridge low and rounded, sometimes double and ending in a faint biangulation; posterior point about midway up from the base; surface covered with rather fine, irregular growth lines; scarcely shining, dirty greenish-yellow with numerous wide or narrow, somewhat broken rays; left valve with two nearly equal, small, erect, slender pseudocardinals and two short laterals; right valve with one pseudocardinal, sometimes with a small one above it; muscle scars well impressed; beak cavities shallow; nacre white, dirty white or bluish, slightly thicker in front. Both male and female shells are somewhat obovate and full in the post-basal region, but the female is most produced at that point. The shells are generally solid and inflated, but old specimens are much more so.

Length (male) 57, height 35, diam. 21 mm.

Length (male) 76, height 50, diam. 33 mm.

Length (female) 52, height 37, diam. 22 mm.

Tennessee River drainage.

Type locality, Caney Fork, Tenn., and Tuscumbia, Ala.

Unio punctatus LEA, Pr. Ac. N. Sci. Phila., IX, 1865, p. 89; Jl. Ac. N. Sci. Phila., VI, 1868, p. 261, pl. XXXII, fig. 76; Obs., XII, 1869, p. 21, pl. XXXII, fig. 76.

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

Lampsilis punctatus SIMPSON, Syn., 1900, p. 542.

Though evidently related to *L. picta* and its allies, this species is quite distinct from all others. The shell is rather neat, the nacre is thick to its edge, and the sides slope very rapidly to the border.

LAMPSILIS PERDIX (Lea).

Shell large, long elliptical, moderately solid, subinflated, with a well-developed posterior ridge; beaks rather full, their sculpture not observed; surface with irregular growth lines, decidedly concentrically ridged in front, nearly smooth at the middle of the shell, roughened on the posterior slope, dirty yellowish-green or tawny, generally marked with faint, wide, broken rays; left valve with two equal-sized, erect pseudocardinals and two remote, small, short laterals; right valve with one very high pseudocardinal, a smaller one in front and sometimes a vestigial one behind it and one rather high, short lateral; muscle scars very large, well impressed; beak cavities rather deep; nacre bluish-white to creamy, silvery, with a wide prismatic border, thickened in front. The male shell does not differ greatly from that of the female, the latter being a little more rounded behind, and having a slight, wide marsupial swelling. Both male and female shells gape slightly at the anterior base.

Length 155, height 100, diam. 60 mm.

Tennessee and Cumberland River systems.

Type locality, Harpeth River, Tenn.

Unio perdix LEA, Tr. Am. Phil. Soc., V, 1827, p. 72, pl. XI, fig. 31; Obs., I, 1834, p. 184, pl. XI, fig. 31.—HANLEY, Biv. Shells, 1843, p. 188, pl. XX, fig. 20.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXIX, fig. 82.

Margarita (Unio) perdix LEA, Syn., 1836, p. 23; 1838, p. 18.

Margaron (Unio) perdix LEA, Syn., 1852, p. 26; 1870, p. 41.

Lampsilis perdix SIMPSON, Syn., 1900, p. 542.

Nephronajas perdix ORTMANN, Ann. Car. Mus., VIII, 1912, p. 326.

Unio pectorosus CONRAD, New F. W. Shells, 1834, p. 37, pl. VI, fig. 1, p. 71; Monog., III, 1836, p. 25, pl. XI, fig. 1.—HANLEY, Biv. Shells, 1843, p. 189, pl. XXI, fig. 22.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 19, pl. II, fig. 8.—KUSTER, Conch. Cab. Unio, 1852, p. 26, pl. IV, fig. 2.

Margarita (Unio) pectorosus LEA, Syn., 1836, p. 23; 1838, p. 18.

A large, rather coarse species, which bears some resemblance to *L. biangularis*. It is rather more compressed and thinner at the edges than *L. ligamentina*. It has very wide prismatic border.

LAMPSILIS VENUSTA (Lea).

Shell irregularly long elliptical, solid, subinflated, with rather compressed but pointed beaks, which are sculptured with fine, distinct, doubly-looped ridges; with a low posterior ridge; with irregular growth lines; greenish-yellow with narrow and wide, somewhat broken, wavy rays; left valve with two equal, erect pseudocardinals and two straight laterals; right valve with one pseudocardinal and a small one above it, with one lateral and sometimes a vestige of another below it; beak cavities shallow; nacre white, scarcely thickened in front. Both male and female shells are full at or behind the middle and somewhat narrowed at the ends. Both are bluntly pointed behind, that of the male midway up from the base, that of the female a little higher up. There is a feeble marsupial swelling just behind the center of the base.

Length 57, height 32, diam. 21 mm.

Type locality, Potosi, Missouri.

Unio venustus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 4, pl. II, fig. 4; Obs., II, 1838, p. 4, pl. II, fig. 4.—HANLEY, Biv. Shells, 1843, p. 192, pl. XXIII, fig. 5.—CHENU, Ill. Conch., 1858, pl. XXII, figs. 1, 1*a*, 1*b*.

Margarita (Unio) venustus LEA, Syn., 1836, p. 24; 1838, p. 19.

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

Lampsilis venustus SIMPSON, Syn., 1900, p. 543.

In some respects this shell approaches *L. ellipsiformis*, in others it has characters of the *ligamentina* group. I hardly know where to place it. There are specimens, which seem close to *L. iris*.

Group of *Lampsilis anodontoides*.

Shell elongated, inflated, moderately solid, sharply pointed behind; that of the female much produced at the posterior base, behind which it is diagonally truncate; epidermis very bright,

smooth and shining, but feebly rayed; beaks not prominent, marked with very delicate, regular sculpture, the posterior loop often open behind; pseudocardinals smooth, generally compressed; nacre shining, white or purplish. Animal having the marsupium very distinct and well rounded below; inner edge of the mantle usually beautifully and evenly toothed behind.

LAMPSILIS ANODONTOIDES (Lea).

Shell large, elongated, with dorsal and ventral lines nearly parallel, rounded in front, pointed behind, more or less inflated, solid; beaks rather full but not high, their sculpture consisting of numerous, distinct ridges looped in the middle but open behind; posterior ridge low and rounded; surface smooth and shining, but often having concentric growth ridges in front, tawny to pale straw-color, sometimes with a few rays on the posterior slope, the rest of the shell generally rayless; there is often a large, brown flush in the umbonal region; ligament large and long; left valve with two subcompressed pseudocardinals, the hinder somewhat elongated, and two long, nearly straight, delicate laterals; right valve with two pseudocardinals, the upper faint, and one lateral; beak cavities not deep; muscle scars rather large, well impressed; nacre white, cream-colored, salmon-tinted or pink, slightly thicker in front. Both male and female shells end behind in a point two-thirds of the way up from the base; the female shell has a large, rounded marsupial swelling and is slightly incurved at the central base.

Length (male) 127, height 62, diam. 45 mm.

Length (female) 120, height 62, diam. 45 mm.

Entire Mississippi River drainage except (probably) the upper Missouri. All the Gulf drainage from the Withlacoochee River, Florida, to the Rio Grande, and into Mexico.

Type locality, Mississippi, Alabama and Ohio Rivers.

Unio anodontoides LEA, Tr. Am. Phil. Soc., IV, 1834, p. 81, pl. VIII, fig. 11; Obs., I, 1834, p. 91, pl. VIII, fig. 11.—CHENU, Ill. Conch., 1858, pl. XIV, figs. 3, 3*a*, 3*b*.—REEVE, Conch. Icon., XVI, 1865, pl. XIX, fig. 87.—SIMPSON, Proc. U. S. Nat. Mus., XV, 1892, p. 430, pl. LXXI, fig. 7, pl. LXXII, figs. 1, 2, 4.

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

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

Lampsilis anodontoides BAKER, Moll. Chicago, Pt. I, 1898, p. 100, pl. x, figs. 1, 2.—SMITH, Bull. U. S. Fish Com., 1899, p. 290, pl. LXXVIII.—SIMPSON, Syn., 1900, p. 543.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 346, fig. 25.

Unio teres SAY, Am. Conch., VI, 1834.—CONRAD, Monog., VI, 1836, p. 52, pl. XXVIII.—KUSTER, Conch. Cab. Unio, 1854, p. 68, pl. XVII, figs. 1, 4.

Var. *floridensis* (Lea).

Shell smaller, thinner, less inflated and in every way more delicate than the type, sometimes with a few faint rays; teeth more compressed; female shell narrowed in front and having the marsupial swelling more near to the center of the shell and more elongated than in the type.

Length (male) 85, height 41, diam. 26 mm.

Length (female) 63, height 33, diam. 19 mm.

Southern Alabama and Georgia to central Florida.

Type locality, Choctawhatchee River, W. Fla.

Unio floridensis LEA, Tr. Am. Phil. Soc., X, 1852, p. 274, pl. XXI, fig. 31; Obs., V, 1852, p. 30, pl. XXI, fig. 31.

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

Lampsilis anodontoides var. *floridensis* SIMPSON, Syn., 1900, p. 544.

An abundant, widespread, variable form. The variety *floridensis* is smaller, generally lighter, and more delicate in every way than the type; the marsupial swelling is not placed so near to the posterior end and the front end of the shell is often narrower. It extends north into southern Georgia, and delicate specimens are found along the Gulf Coast into Texas. At Mier, Mexico, a rather short variety is found.

The species is solider, larger and higher in proportion than *L. fallaciosa*, is not quite so inflated as that species, and is gen-

erally less rayed. There are occasional specimens of the variety that are feebly rayed.

I have no doubt but that Lea included in his description both *anodontoides* and *fallaciosa*, for he says that the shell is sometimes almost cylindrical and again that "in some specimens, the arcuation of the basal margin is so great that it might almost be taken for a malformation." But his figure shows the heavy, higher, unicolored, larger shell, that of a female, with rather solid pseudocardinals and we are therefore compelled to accept this for his species.

LAMPSILIS FALLACIOSA (Smith) Simpson.

Shell elongated, the hinge and ventral lines nearly parallel, subcylindrical, subsolid, generally inflated; beaks full but not high, their sculpture numerous, distinct, fine ridges looped up in the center, open behind; ligament long, brown, rather narrow; anterior end rounded; posterior part ending in a rather sharp point more than midway up from the base of the shell; surface very smooth and glossy, slightly concentrically ridged at the anterior end; color greenish-yellow or yellowish-green, often faintly rayed and always darker on the posterior slope. Left valve with two high, compressed pseudocardinals and two delicate, nearly straight, laterals; right valve with two pseudocardinals, the upper smaller and more compressed and one lateral; beak cavities moderate; muscle scars well impressed; nacre white, straw-colored or salmon-tinted.

Length (male) 90, height 37, diam. 32 mm.

Length (female) 90, height 40, diam. 33 mm.

Upper Mississippi drainage; south to the Cumberland River, Tennessee, and to Arkansas; Red River of the North?

Unio anodontoides REEVE, Conch. Icon., XVI, 1865, pl. XXI, fig. 97.

Lampsilis anodontoides BAKER, Moll. Chicago, Pt. I, 1898, pl. X, fig. 3.

Unio oriens SOWERBY, Conch. Icon., XVI, 1868, pl. LXIII, fig. 314.

Lampsilis fallaciosus SMITH, Bull. U. S. Fish Com., 1899, p. 291, pl. LXXIX.—SIMPSON, Pr. Ac. N. Sci., Phila., 1900, p. 74, pl. II, fig. 5; Syn. 1900, p. 544.

This has generally passed for the true *anodontoides,* and there are occasional specimens, which stand so completely between the two that they can only with difficulty be referred to either. The *L. fallaciosa* never reaches the dimensions of *anodontoides,* it is thinner, more delicate in every way, more inflated as a rule and the hinge teeth are more compressed. As a general thing it is not as high in proportion as *anodontoides* and the posterior point is more drawn out, and this lengthening behind is especially noticeable in the male shells. The *fallaciosa* is generally tinted with green, it sometimes is all green, and it is far more likely to be rayed than its congener. This species often has a dark flush at the umbonal region, and I have seen specimens of both it and *anodontoides,* in which the burnt brown covered the whole shell.

LAMPSILIS VIRESCENS (Lea).

Shell long elliptical or long obovate, subinflated, subsolid, with a low posterior ridge, with moderately full beaks, which are sculptured with numerous, delicate ridges looped up in the middle and open behind; surface rather smooth, scarcely shining, greenish-straw-colored, sometimes faintly rayed, especially on the posterior slope; left valve with two compressed, elevated pseudocardinals and two slightly curved, delicate laterals; right valve with two pseudocardinals, the upper smaller and much compressed, and one lateral; beak cavities rather deep; muscle scars shallow; nacre bluish-white, iridescent. Both male and female shells are somewhat produced at the posterior base, the female but slightly more than the male, and both are bluntly pointed behind midway up, or a little more than that, above the center of the shell.

Length 67, height 40, diam. 25 mm.

Tennessee River in northern Alabama.

Type locality, Tennessee River, Tuscumbia, Ala.

Unio virescens LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 40; Jl. Ac. N. Sci. Phila., IV, 1860, p. 341, pl. LV, fig. 166; Obs., VIII, 1860, p. 23, pl. LV, fig. 166.
Margaron (Unio) virescens LEA, Syn., 1870, p. 42.
Lampsilis virescens SIMPSON, Syn., 1900, p. 544.

This species seems to show affinities with members of the *luteola* and *ventricosa groups*. Some specimens are apparently close to *L. anodontoides*, but this species is much smaller, higher in proportion to its length, and there is, apparently, not so much difference between male and female shells.

LAMPSILIS AUSTRALIS Simpson.

Shell elongate ovate or long elliptical, subinflated, subsolid, with a low, rounded post-ridge; beaks not high, the sculpture not seen; surface smooth, shining, with faint, irregular growth lines, greenish-yellow with feeble rays, a considerable space of the disk in the umbonal region is dark umber-color or blackish; left valve with two erect, somewhat compressed pseudocardinals, and two lamellar, slightly curved laterals; right valve with two pseudocardinals, the upper the smaller, and one lateral; beak cavities shallow; muscle scars rather shallow; nacre bluish-white, not thickened anteriorly. The type may be a young female. The two shells seen are rounded in front and slightly full behind the middle at the base, and pointed behind.

Length (type) 52, height 27, diam. 15 mm.

Length (co-type) 72, height 38, diam. 24 mm.

Type locality, Little Patsaliga Creek, southeastern Alabama.
Lampsilis australis SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 75, pl. II, fig. 2; Syn. 1900, p. 544.

Only two specimens, the type and co-type, have been seen. The figured type is a young, fairly healthy shell, the other specimen is larger and has been injured probably by a Trematod, as the teeth and cavity are brown or salmon-colored and rough. The posterior end of this shell is slightly injured and drawn down. Apparently a member of the *anodontoides* group, and most nearly related to *L. recta*, being nearly the

color of certain specimens of that species from Michigan, but it is shorter, less solid and inflated than that species, and has a large, dark blotch on the central and upper part of the shell.

LAMPSILIS RECTA (Lamarck).

Shell large, elongated, dorsal and ventral lines nearly parallel, solid, inflated, rounded in front, pointed behind; with full but rather low beaks, whose sculpture consists of faint, delicate ridges, scarcely doubly looped; posterior ridge rather low, rounded; ligament long; surface faintly and irregularly, concentrically sculptured, varying from black to olive-green, generally lighter colored in the umbonal region, the young and sometimes older shells often faintly rayed, left valve with two nearly equal, ragged, erect pseudocardinals and two long, slightly curved laterals; right valve with one pseudocardinal, a feeble, compressed one above it, and one lateral with a vestige of a second below it; muscle scars well impressed, smooth; beak cavities shallow, with two or three deep dorsal scars; nacre purple or bluish-white, often whitish, with a purple flush at the beak cavities. The male shell is drawn out behind and ends in a blunt point about midway up from the base; the female shell has a long, rounded marsupial swelling and ends in a more blunt point two-thirds of the way up from the base.

Length 150, height 65, diam. 45 mm.

Entire Mississippi drainage; Alabama River drainage; Red River of the North; St. Lawrence system.

Type locality, Lake Erie.

Unio recta LAMARCK, An. sans Vert., VI, 1819, p. 74.—VALENCIENNES, Rec. Obs. Zool., II, 1833, p. 234, pl. LIV, fig. 1.

Unio (Ligumia) recta SWAINSON, Treat. on Mal., 1840, pp. 267, 274, fig. 55.

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

Unio rectus CONRAD, Monog., III, 1836, p. 33, pl. XV,—POTIEZ and MICHAUD, Gall. Moll., 1844, II, p. 149, pl. LVII, figs. 3, 4. —KUSTER, Conch. Cab. Unio, 1852, p. 35, pl. VI, fig. 1; pl. VII, fig. 1.—CHENU, Man., 1859, II, p. 139, fig. 675.—REEVE, Conch. Icon., XVI, 1865, pl. XIX, fig. 86.—CALL, Tr. Ac. Sci. St. Louis, VII, 1895, p. 43, pl. VII.

Margarita (Unio) rectus LEA, Syn., 1836, p. 34; 1838, p. 23.
Margaron (Unio) rectus LEA, Syn., 1862, p. 35; 1870, p. 57.
Lampsilis rectus SMITH, Bull. U. S. Fish Com., 1899, p. 290. pl. LXXVIII.—SIMPSON, Syn., 1900, p. 544.
Unio latissima RAFINESQUE, An. Gen. Sci. Phys. Brux., Pt. 13, V, 1820, p. 297, pl. LXXX, figs. 14, 15.
? Unio prælongus BARNES, Am. Jl. of Sci., VI, 1823, p. 261, pl. XIII, fig. 11.—HILDRETH, Am. Jl. of Sci., XIV, 1828, p. 286, fig. 18.
Mya prælonga EATON, Zool. Text-Book, 1826, p. 220.—WOOD, Ind. Test. (Hanley), 1856, p. 200, pl. 1, Supp., fig. 11.
Eurynea prælonga STIMPSON, Shells of N. Eng., 1851, p. 13.
? Unio arquatus CONRAD, Jl. Ac. N. Sci. Phila., 1854, p. 297, pl. XXVI, fig. 8.
Unio leprosus MILES, Rep. Geol. Sur. Mich., 1861, p. 240.

Var. *sageri* (Conrad).

Shell smaller than the type, with a more decided posterior ridge, below which it is somewhat compressed; color chestnut, tawny, greenish or olive, often faintly rayed, rest periods generally well marked; nacre bluish-white, rarely tinted purplish, often blotched; marsupial swelling moderate.

Length 95, height 42, diam. 28 mm.

Type locality, Detroit River, Michigan. Also, Red River of the North.

Unio sageri CONRAD, Monog., VI, 1836, p. 53, pl. XXIX, fig. 1.

A very common, widely distributed form that should not be mistaken for any other. Conrad's figure of *Unio sageri* is hardly characteristic, being too high in proportion to its length. The northern form is probably worthy of a varietal name. The specimens from the Alabama River drainage are smaller than those from the Mississippi Valley, but do not differ sufficiently to require a varietal name.

DeCamp's *Unio anodontoides*, reported from Michigan, is a tawny-colored variety of this species according to Walker, the *Unio sageri* of Conrad.

Group of *Lampsilis nasuta*.

Shell elongated, thin, compressed, with a distinct posterior ridge, and drawn out to a long, pointed beak behind; epiderdermis rather dull, olive-green, and feebly rayed; beaks low, sculptured with fine, close-set ridges, which are slightly looped in front and are parallel with the axis of the shell behind; hinge teeth delicate and compressed; nacre bluish; female shell not greatly produced in the post-basal region. Animal with the marsupium often occupying the greater part of the length of the outer gills posteriorly; inner gills free or united to the abdominal sac.

LAMPSILIS NASUTA (Say).

Shell elongated, subcompressed, thin to subsolid, with a well-developed posterior ridge which is usually curved down in the middle; rounded in front; full at the base just behind the center, and drawn out to a long point behind midway up the height of the shell; beaks low, sculptured with fine, close ridges, which are looped in front and run parallel with the axis of the shell behind; surface having irregular growth lines, and sometimes having a few nearly vertical ribs below the posterior ridges; scarcely shining, dark olive to brownish or tawny, often faintly rayed, especially when young; left valve with a sort of double, compressed pseudocardinal and two delicate, nearly straight laterals; right valve with one compressed pseudocardinal, a faint one above it, and a lamellar lateral; beak cavities shallow, with a row of dorsal scars visible; muscle scars shallow, the posterior indistinct; nacre bluish-white, lurid, flesh-tinted or purplish. Female shell with a long marsupial swelling just behind the center, not differing greatly from that of the male.

Length 77, height 35, diam. 18 mm.

St. Lawrence drainage; streams flowing into the Atlantic south to North Carolina.

Type locality, Delaware and Schuylkill Rivers.

Unio nasutus SAY, Nich. Encyc., 1st ed., 1817, pl. IV, fig. 1.—SWAINSON, Zool. Ill., 1st ser., I, 1821, pl. LVII.—CONRAD, Monog., IV, 1836, p. 38, pl. XVIII, fig. 1, part.—GOULD, Inv.

of Mass., 1841, p. 109, fig. 71.—Binney, Gould's Inv., 1870, p. 169, fig. 473.—De Kay, Zool. of N. Y., Pt. 5, 1843, p. 191, pl. xx, fig. 239.—Kuster, Conch. Cab. Unio, 1861, p. 223, pl. lxxv, fig. 4.—Reeve, Conch. Icon., XVI, 1865, pl. xxi, fig. 94.—Hartman and Michener, Conch. Cest., 1874, p. 70, fig. 186.

Margarita (Unio) nasutus Lea, Syn., 1836, p. 37; 1858, p. 24.

Margaron (Unio) nasutus Lea, Syn., 1852, p. 37; 1870, p. 60.

Lampsilis nasutus Simpson, Syn., 1900, p. 545.

Mya nasuta Eaton, Zool. Text-Book, 1826, p. 218.—Wood, Index Test. (Hanley), 1856, p. 199, pl. 1, Supp., fig. 4.

Eurynea nasuta Agassiz, Shells of New Eng., 1851, p. 13.

Eurynia (Eurynia) nasuta Ortmann, Am. Car Mus., VIII, 1912, p. 343.

Unio rostrata Valenciennes, Rec. Obs. Zool., II, 1833, p. 233, pl. liii, fig. 3.

Unio vaughanianus Sowerby, Conch. Icon., XVI, 1868, pl. lxi, fig. 308.

No other living species seems to be very closely related to this, though *Unio fisherianus* is often mistaken for it. The latter is a smaller, more compressed, smoother species, and its male and female shells are alike. There is a variety of *Lampsilis subrostrata* found in the Wabash and in northern Ohio that sometimes resembles *nasuta*, but the posterior beak is not nearly so greatly drawn out.

Group of *Lampsilis subrostrata*.

Shell elliptical to elongate, distinctly pointed behind, the point well above the middle of the height, that of the female conspicuously swollen at the posterior base and obliquely truncated behind; epidermis varying from olive to brown, generally more or less rayed and slightly roughened; beaks not prominent, sculptured with fine, delicate, parallel bars, which are somewhat looped in front and generally descend obliquely behind; pseudocardinals usually compressed; nacre bluish to purple. Animal with inner gills often more or less free from the abdominal sac; posterior base of mantle of female generally toothed.

LAMPSILIS SUBROSTRATA (Say).

Shell elongated, irregularly elliptical, subsolid, somewhat inflated, with moderately full beaks sculptured with numerous delicate ridges that are sharply drawn up in the middle; very slightly winged; rounded in front and rather sharply pointed behind; growth lines irregular; posterior ridge moderately developed; surface dull, dirty greenish-yellow, generally having faint, wide, wavy rays on the hinder portion, often having concentric bands of lighter and darker color; teeth compressed, two pseudocardinals in each valve, the upper in the right smaller, one lamellar lateral in the right valve and two in the left; muscle scars shallow; beak cavities moderate; nacre bluish-white, scarcely thicker in front. The dorsal and ventral lines of the male shell are nearly parallel; it is more or less angled at the post-base and ends behind in a rather sharp point above the middle; the female shell is narrowed in front, with a very large, rounded marsupial swelling and in front of this the basal line is incurved.

Length (male) 70, height 35, diam. 23 mm.

Length (female) 62, height 35, diam. 23 mm.

Entire Mississippi drainage north to about latitude 41°. Eastern half of Texas.

Type locality, Wabash River.

Unio subrostratus SAY, N. Harmony Diss., Jan. 15, 1831.

Lampsilis subrostratus SIMPSON, Syn., 1900, p. 546.

Eurynia (Eurynia) subrostrata ORTMANN, Ann. Car. Mus., VIII, 1912, p. 344.

Unio nashvillianus LEA, Tr. Am. Phil. Soc., V, 1834, p. 100, pl. XIV, fig. 43; Obs., I, 1834, p. 212, pl. XIV, fig. 43.—HANLEY, Biv. Shells, 1843, p. 193, pl. XXIII, fig. 31.—KUSTER, Conch. Cab. Unio, 1861, p. 224, pl. LXXVI, figs. 1, 2.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXX, fig. 158.

Margarita (Unio) nashvillianus LEA, Syn., 1836, p. 26; 1838, p. 20.

Margaron (Unio) nashvillianus LEA, Syn., 1852, p. 29.

Margaron (Unio) nashvillensis LEA, Syn., 1870, p. 45.

Unio mississippiensis CONRAD, Jl. Ac. N. Sci. Phila., I, 1850, p. 277, pl. XXXVIII, fig. 11.—KUSTER, Conch. Cab. Unio, 1861, p. 245, pl. LXXXII, fig. 3.—REEVE, Conch. Icon., XVI, 1865, pl. XIX, fig. 85.

Margaron (Unio) mississippiensis LEA, Syn., 1852, p. 29; 1870, p. 60.

Unio rutersvillensis LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 155; Jl. Ac. N. Sci. Phila., IV, 1860, p. 355, pl. LX, fig. 181; Obs., VIII, 1860, p. 38, pl. LX, fig. 181.

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

Unio topekaensis LEA, Pr. Ac. N. Sci. Phila., XII, 1868. p. 144; Jl. Ac. N. Sci. Phila., VI, 1869, p. 313, pl. XLIX, fig. 126; Obs., XII, 1869, p. 73, pl. XLIX, fig. 126.

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

Unio cocoduensis REEVE, Conch. Icon., XVI, 1865, pl. XXIV, fig. 117.

Var. *furva* n. v.

Shell generally more attenuated than the type and less inflated, the marsupial swelling not so greatly developed. Epidermis varying from pale or smoky-brown to chestnut, not smooth or shining, occasionally with a few, faint posterior rays. In a few cases this form has much the same size and shape of typical specimens, but the color of the epidermis is always dark and nearly rayless.

Type locality, North Indiana; Maumee River.

An abundant species, especially in the southwest. Lea's *Unio nashvillianus* appears to be a rather short, smooth, solid form. The variety *furva* comes from northeastern Indiana and probably from the Maumee River drainage and seems to be almost distinct enough to be worthy of specific rank. Certain specimens of it approach *L. nasuta,* but it is rather more inflated than that species and the marsupial swelling is placed farther back; besides, it is differently colored.

LAMPSILIS LIENOSA (Conrad).

Shell long elliptical or slightly obovate, generally solid and inflated, with a faint posterior ridge; beaks moderate, the sculp-

ture not seen; surface with irregular growth lines, often more or less sulcate, varying from dirty tawny to black, often faintly rayed behind; left valve with two granularly roughened pseudocardinals and two curved laterals; right valve with one pseudocardinal, a feeble lamellar tooth above, and one lateral with a vestige of another below it in old shells; laterals granular; muscle scars small, well impressed; nacre white, salmon or flesh-colored, sometimes deep purple, slightly thicker in front. The male is often nearly rounded or sub-biangular behind, the posterior end at or above the middle of the height; the female shell is considerably swollen at the posterior base, and its posterior end is more elevated than that of the male.

Length 70, height 43, diam. 30 mm.

Lower Mississippi River drainage north to the lower Ohio and Wabash; east to southwest Georgia.

Type locality, small streams in southern Alabama.

Unio lienosus CONRAD, Am. Jl. Sci., XXV, 1834, p. 339, pl. 1, fig. 4; Monog., VII, 1836, p. 60, pl. XXXIV, fig. 2.—HANLEY, Biv. Shells, 1843, p. 194, pl. XXI, fig. 32.—KUSTER, Conch. Cab. Unio, 1852, p. 67, pl. XVI, fig. 3.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXII, fig. 166; 1868, pl. LXXV, fig. 388.

Margarita (Unio) lienosus LEA, Syn., 1836, p. 26; 1838, p. 20.

Margaron (Unio) lienosus LEA, Syn., 1852, p. 29; 1870, p. 45.

Lampsilis lienosus SIMPSON, Syn., 1900, p. 547.

Unio saxeus CONRAD, Monog., XII, 1840, p. 109, pl. IX, fig. 1.

Margaron (Unio) saxeus LEA, Syn., 1852, p. 27; 1870, p. 42.

Unio caliginosus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 165; Tr. Am. Phil. Soc., X, 1848, p. 79, pl. VII, fig. 21; Obs., IV, 1848, p. 53, pl. VII, fig. 21.—KUSTER, Conch. Cab. Unio, 1861, p. 180, pl. LVI, fig. 7.

Margaron (Unio) caliginosus LEA, Syn., 1852, p. 29; 1870, p. 45.

Unio fontanus CONRAD, Am. Jl. Sci., II, 1866, p. 279, pl. XV, fig. 13.

Var. *unicostata* (B. H. Wright).

Shell smaller than typical *lienosa* and having in some cases a faint radial ridge running down the posterior slope. It is hard

to say just what this is, as it has the dull, dark color of *lienosa* but something of the form of *concestator* and it may be a variety of the latter.

Type locality, Spring Creek, Decatur Co., Ga.

Unio unicostatus B. H. WRIGHT, Naut. XIII, 1899, p. 69.

Lampsilis lienosus var. *unicostatus* SIMPSON, Syn., 1900, p. 547.

LAMPSILIS CONCESTATOR (Lea).

Shell elliptical or irregularly obovate, subinflated, subsolid, the beaks moderately full with a few doubly-looped ridges; the growth lines irregular; surface varying from yellowish or dirty tawny to blackish, generally having a few faint rays behind and somewhat shining; teeth granular; there are two subcompressed pseudocardinals in the left valve and one and a vestige of another in the right; two lamellar laterals in the left valve and one in the right; muscle scars shallow; nacre whitish-flesh or straw-colored, salmon or deep purple, not much thickened in front. The male shell is nearly evenly elliptical or slightly obovate, the female shell is narrowed in front and greatly produced at the post-basal region, it ends behind in an elevated and much sharper point than that of the male.

Length (male) 60, height 38, diam. 25 mm.

Length (female) 55, height 38, diam. 26 mm.

North Carolina, in streams flowing into the sea, to Louisiana, and possibly to Texas.

Type locality, creeks, Columbus, Ga.

Unio concestator LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 31; Jl. Ac. N. Sci. Phila., IV, 1858, p. 66, pl. XII, fig. 48; Obs., VI, 1858, p. 66, pl. XII, fig. 48.—KUSTER, Conch. Cab. Unio, 1861, p. 178, pl. LVI, fig. 3.—REEVE, Conch. Icon., XVI, 1865, pl. XXVI, fig. 128.—SIMPSON, Pr. U. S. Nat. Mus., XVI, 1892, p. 416, pl. LVIII, figs. 2-4.

Margaron (Unio) concestator LEA, Syn., 1870, p. 45.

Lampsilis concestator SIMPSON, Syn., 1900, p. 548.

Unio intercedens LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 32; Jl. Ac. N. Sci. Phila., IV, 1858, p. 77, pl. XV, fig. 57; Obs., VI, 1858, p. 77, pl. XV, fig. 57.

Margaron (Unio) intercedens LEA, Syn., 1870, p. 45.

Unio fallax LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 32; Jl. Ac. N. Sci. Phila., IV, 1858, p. 79, pl. XV, fig. 59; Obs., VI, 1858, p. 79, pl. XV, fig. 59.—KUSTER, Conch. Cab. Unio, 1861, p. 206, pl. LXVIII, fig. 7.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXX, fig. 418.

Margaron (Unio) fallax LEA, Syn., 1870, p. 45.

Unio contiguus LEA, Proc. Ac. N. Sci. Phila., VI, 1861, p. 392; Jl. Ac. N. Sci. Phila., V, 1862, p. 199, pl. XXVIII, fig. 268; Obs., IX, 1863, p. 21, pl. XXVIII, fig. 268.

Margaron (Unio) contiguus LEA, Syn., 1870, p. 45.

Unio bi-cælatus REEVE, Conch. Icon., XVI, 1865, pl. XXVI, fig. 130.

Unio genuinus LEA, Pr. Ac. N. Sci. Phila., XX, 1868, p. 161; Jl. Ac. N. Sci. Phila., VI, 1868, p. 305, pl. XLVI, fig. 117; Obs., XII, 1869, p. 64, pl. XLVI, fig. 117.

Margaron (Unio) genuinus LEA, Syn., 1870, p. 45.

Very close to *L. lienosa*, and there are specimens which I am unable to satisfactorily determine. As a rule *lienosa* is a larger shell, is darker colored and not quite so shining, and it is solider.

LAMPSILIS PROPRIA (Lea).

Shell rather small, long elliptical or subrhomboid, subsolid and subinflated, with rather low beaks, with a low, rounded posterior ridge; surface generally smooth, pale, smoky yellowish, sometimes with very faint rays behind; pseudocardinals subcompressed; laterals short and lamellar; muscle scars shallow; nacre whitish, darker and often salmon or purplish in the center of the valves, but slightly thicker in front. Male shell subrhomboid, the somewhat rounded posterior point being near the base of the shell; female shell with but a moderate marsupial swelling, the posterior point a little more than midway up from the base.

Length 37, height 23, diam. 15 mm.

Walker County, Georgia; Clinch River, Virginia.

Type locality, Lafayette, Ga.

Unio proprius LEA, Pr. Ac. N. Sci. Phila., IX, 1865, p. 89; Jl. Ac. N. Sci. Phila., VI, 1869, p. 256, pl. XXXI, fig. 70; Obs., XII, 1869, p. 16, XXXI, fig. 70.

Margaron (Unio) proprius LEA, Syn., 1870, p. 45.

Lampsilis proprius SIMPSON, Syn., 1900, p. 548.

? Unio striatus SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVIII, fig. 407.

This may be only a variety of *L. vanuxemensis*, a most abundant and variable species. It is smaller than that shell and generally more tawny or yellowish.

LAMPSILIS PUNICEA (Haldeman).

"Shell ovate elliptical, regularly inflated, rather thick in texture; short and obtuse anteriorly; slightly narrowed, and obtusely rounded posteriorly; umbones eroded, and not elevated above the dorsal outline; umbonical slope undefined, posterior slope elevated; anterior teeth thick and direct, posterior ones short and straight; epidermis smooth, yellowish-brown, with well-defined dark green rays upon the posterior margin of the shell; inside light reddish-orange.

Length 2.2, height 1.2, diam. 0.8 inch. Hab.: Holston River, Washington County, Virginia. Distinguished from *U. tenebrosus* by having more robust and direct teeth; and from *U. muhlfeldianus*, by being higher and more obtusely rounded in front, and less so posteriorly."

Unio puniceus HALDEMAN, Jl. Ac. N. Sci. Phila., VIII, 1842, p. 201.

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

Lampsilis puniceus SIMPSON, Syn., 1900, p. 548.

This species has never been figured, but from the description I take it to be a member of the *subrostrata* group, and it is very likely a synonym of some of the other species, a male *L. vanuxemensis* possibly. I give Haldeman's description and remarks.

LAMPSILIS VANUXEMENSIS (Lea).

Shell elliptical or irregularly obovate, rather solid, somewhat inflated, with a scarcely developed posterior ridge; beaks rather low, their sculpture a few ridges looped up in the middle; surface with irregular, concentric growth lines, which are often somewhat sulcate, dull colored, not shining, varying from dirty tawny through olive to nearly black; there are two rather stumpy pseudocardinals in the left valve and one and a vestige of another in the right; two curved laterals in the left valve and one in the right; muscle scars shallow, the posterior ones round; nacre varying from dirty purplish-white through salmon-tinted to dark purple, often darker in the cavity of the shell, slightly thicker in front, not bright. Male shell long elliptical, rather full at the posterior base and moderately sharp pointed behind about midway up the height of the shell. The female shells have a large, prominent marsupial swelling at the extreme posterior base and the shell is truncated from this to the posterior point, which is situated two-thirds of the way up from the base. All the female shells I have seen are smaller than those of the males.

Length (male) 58, height 36, diam. 23 mm.

Length (female) 41, height 27, diam. 20 mm.

Cumberland and Tennessee River systems; headwaters of the Coosa.

Type locality, Cumberland River, Tenn.

Unio vanuxemensis LEA, Tr. Am. Phil. Soc., VI, 1838, p. 36, pl. XI, fig. 31; Obs., II, 1838, p. 36, pl. XI, fig. 31.—HANLEY, Biv. Shells, 1843, p. 193, pl. XXII, fig. 56.—CHENU, Ill. Conch., 1858, pl. XIX, figs. 3, 3*a*, 3*b*.—KUSTER, Conch. Cab. Unio, 1862, p. 272, pl. XCI, fig. 6.

Margarita (Unio) vanuxemensis LEA, Syn., 1836, p. 26; 1838, p. 19.

Margaron (Unio) vanuxemensis LEA, Syn., 1852, p. 29.

Lampsilis vanuxemensis SIMPSON, Syn., 1900, p. 549.

Eurynia (Micromya) vanuxemensis ORTMANN, Ann. Car. Mus., VIII, 1912, p. 342.

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

Unio vanuxemii B. H. WRIGHT, Check List, 1888.

Unio nitens LEA, Pr. Am. Phil. Soc., I, 1840, p. 288; Tr. Am. Phil. Soc., VIII, 1843, p. 205, pl. XII, fig. 19; Obs., III, 1842, p. 43, pl. XII, fig. 19.—KUSTER, Conch. Cab., 1856, p. 163, pl. XLVII, fig. 1.—CHENU, Ill. Conch., 1858, pl. XXVIII, figs. 5, 5*a*, 5*b*.—REEVE, Conch. Icon. XVI, 1865, pl. XXVIII, fig. 144.

Margaron (Unio) nitens LEA, Syn., 1852, p. 29; 1870, p. 45.

Unio umbrosus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 32.

Unio umbrans LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 104; Jl. Ac. N. Sci. Phila., V, 1858, p. 72, pl. XIII, fig. 53; Obs., VI, 1858, p. 72, pl. XIII, fig. 53.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIV, fig. 179.

Margaron (Unio) umbrans LEA, Syn., 1870, p. 45.

Unio tenebricus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 171; Jl. Ac. N. Sci. Phila., IV, 1858, p. 83, pl. XVII, fig. 63; Obs., VI, 1858, p. 83, pl. XVII, fig. 63.

Margaron (Unio) tenebricus LEA, Syn., 1870, p. 45.

Unio pybasii LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 40; Jl. Ac. N. Sci. Phila., V, 1862, p. 67, pl. VI, fig. 216; Obs., VIII, 1862, p. 71, pl. VI, fig. 216.

Margaron (Unio) pybasii LEA, Syn., 1870, p. 45.

Unio fabaceus LEA, Proc. Ac. N. Sci. Phila., V, 1861, p. 38; Jl. Ac. N. Sci. Phila., V, 1862, p. 90, pl. XIII, fig. 238; Obs., VIII, 1862, p. 94, pl. XIII, fig. 238.

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

Unio copei LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 144; Jl. Ac. N. Sci. Phila., VI, 1869, p. 307, pl. XLVII, fig. 120; Obs., XII, 1869, p. 67, pl. XLVII, fig. 120.

Margaron (Unio) copei LEA, Syn., 1870, p. 45.

Unio dispansus LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 191; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 19, pl. VI, fig. 16; Obs., XIII, 1874, p. 23, pl. VI, fig. 16.

A very abundant and variable species found in the Cumberland, Tennessee and Alabama River systems. *Unio tenebricus* Lea seems to be a smaller, somewhat stunted form, but the transition to the type is so complete that I do not think it

worthy of even varietal rank. *Unio copei* is a little thinner and shorter than the ordinary manifestation of the species, and I am doubtful whether it is normal.

LAMPSILIS OBSCURA (Lea).

Shell long elliptical, subsolid, subinflated, rounded in front and pointed or slightly biangulate behind about midway up from the base; beaks rather low, with fine, double-looped sculpture; growth lines irregular, sulcated in front, the rest periods well marked; epidermis dirty greenish-yellow or yellowish-green, with very delicate, scarcely shining rays; there are two subcompressed pseudocardinals in each valve, the upper one in the right valve the smaller; one lateral in the right valve and two in the left; beak cavities shallow; muscle scars not deep; nacre whitish at the edge, becoming purple in the cavity of old shells. All the shells I have seen that are adult appear to be males.

Length 51, height 28, diam. 19 mm.

Tennessee and Cumberland River systems; Lower Ohio and its tributaries.

Type locality, Nashville, Tenn.

Unio obscurus LEA, Tr. Am. Phil Soc., VI, 1839, p. 7, pl. III, fig. 7; Obs., II, 1838, p. 7, pl. III, fig. 7.—HANLEY, Biv. Shells, 1843, p. 194, pl. XXII, fig. 58.—CHENU, Ill. Conch., 1858, pl. XVII, figs. 1, 1*a*, 1*b*.—KUSTER, Conch. Cab. Unio, 1861, p. 220, pl. LXXIV, fig. 3.

Margarita (Unio) obscurus LEA, Syn., 1836, p. 26; 1838, p. 20.

Margaron (Unio) obscurus LEA, Syn., 1852, p. 29; 1870, p. 45.

Lampsilis obscurus SIMPSON, Syn., 1900, p. 549.

Margarita (Unio) zeiglerianus LEA, Syn., 1836, p. 26; 1838, p. 20.

Unio zeiglerianus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 32, pl. X, fig. 27; Obs., II, 1838, p. 32, pl. X, fig. 27.—HANLEY, Biv. Shells, 1843, p. 193, pl. XXII, fig. 57.—CHENU, Ill. Conch., 1858, pl. XXIV, figs. 2, 2*a*, 2*b*.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVI, fig. 19.

Margaron (Unio) zeiglerianus LEA, Syn., 1852, p. 29.

Margaron (Unio) zieglerianus LEA, Syn., 1870, p. 45.

A puzzling form which is probably only a variety of *vanuxemensis*. Lea's types of *obscura* and *ziegleriana* are probably the same, the latter being a younger shell. Lea has four young shells bearing the latter name, and I have seen two or three elsewhere, which may possibly not be this, but a related, undescribed species. The young shells I have seen are very delicately rayed, the rays showing through at the posterior end, and are certainly different from the young of *vanuxemensis*. I cannot be positive whether these young specimens develop into the mature *ziegleriana* or not as I have not seen material in all stages of growth.

LAMPSILIS PRATTII (Lea).

Shell small, elliptical or obovate, rather thin, somewhat inflated, smooth and shining, yellowish-green or pale olive with feeble rays; beaks rather low, placed a little in front of the center of the shell, their sculpture not seen; there are two compressed pseudocardinals in each valve, the upper in the right valve small; two short, straight laterals in the left valve and one in the right; beak cavities shallow; muscle scars slightly impressed; nacre bluish, dirty purplish in the center, iridescent behind, slightly thicker in front. The male shell is nearly regularly elliptical; the female has a well-developed post-basal swelling, and both are bluntly pointed behind.

Length 33, height 22, diam. 14 mm.

Chattahoochee River, Georgia.

Type locality, Chattahoochee River, Roswell, Cobb Co., Ga.

Unio prattii LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 166; Jl. Ac. N. Sci. Phila., IV, 1859, p. 206, pl. XXIV, figs. 88, 88*a*; Obs., VII, 1859, p. 24, pl. XXIV, fig. 88, 88*a*.

Margaron (Unio) prattii LEA, Syn., 1870, p. 45.

Lampsilis prattii SIMPSON, Syn., 1900, p. 550.

A rather attractive little species, which has a somewhat different texture from any near allied forms. It is thinner and more shining than *vanuxemensis*, and the nacre is more iridescent behind than it is in that species.

LAMPSILIS VAUGHANIANA (Lea).

Shell subsolid, somewhat inflated, rounded and narrowed in front, pointed behind; beaks not high, their sculpture not seen; surface with strong, irregular growth lines, dirty yellowish-green or bottle-green with numerous feeble, wavy rays; there are two pseudocardinals in the right valve, the upper small and compressed, and one lateral; two rather stout, small, erect pseudocardinals in the left valve and two laterals; beak cavities not deep, but compressed, with a few dorsal scars. Anterior muscle scars separate, distinct; posterior scars faint; nacre dirty white or straw-colored, iridescent behind, considerably thickened in front. I have only seen two shells of this species, both females. They are narrowed in front and pointed about two-thirds of the way up behind and have a very full, posterior, basal swelling. From this swelling to the posterior point the outline is straight or slightly emarginate.

Length 50, height 30, diam. 17 mm.

Type locality, Sawney's Creek, near Camden, South Carolina.

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

Unio vaughanianus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 5, pl. III, fig. 5; Obs., II, 1838, p. 5, pl. III, fig. 5.—HANLEY, Biv. Shells, 1843, p. 208, pl. XXII, fig. 48.—CHENU, Ill. Conch., 1858, pl. XXI, figs. 11*a*, 11*b*.

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

Lampsilis vaughanianus SIMPSON, Syn., 1900, p. 550.

Close to *L. ogeecheensis* Conrad, and may be only a solid, dark, obscurely rayed variety of it. It is rather more inflated than that species, and narrower in front.

LAMPSILIS OGEECHEENSIS (Conrad).

Shell long elliptical or long obovate, rather thin, subinflated, with low beaks that have slightly doubly-looped sculpture; surface with irregular growth lines, generally rather smooth and shining, pale greenish-yellow with bright, narrow or wide,

broken, green rays, often so disposed as to have concentric bands of the ground color; pseudocardinals compressed, two in each valve; two delicate laterals in the left valve and one in the right; beak cavities quite shallow; anterior scars not impressed; posterior scars very faint; nacre dirty pinkish or bluish with a purplish center, not thickened in front. The female shell is shorter and higher than the male; it has a much-produced marsupial swelling and a blunt posterior point two-thirds of the way up from the base, the outline between these two points is straight or faintly emarginate; the male shell is pointed behind about midway up from the base.

Length (male) 57, height 32, diam. 20 mm.

Length (female) 53, height 36, diam. 23 mm.

Neuse River, North Carolina; south to north Florida; west to the Etowah River, Georgia; Duck River, Tennessee.

Type locality, Ogeechee River, Ga.

Unio ogeecheensis CONRAD, Ann. and Mag., N. Hist., IV, 1849, p. 300; Jl. Ac. N. Sci. Phila., I, 1850, p. 275, pl. XXXVII, figs. 3, 4.

Lampsilis ogeecheensis SIMPSON, Syn., 1900, p. 550.

Unio prevostianus LEA, Tr. Am. Phil. Soc., X, 1852, p. 269, pl. XIX, fig. 24; Obs., V, 1852, p. 25, pl. XIX, fig. 24.—MUSGRAVE, Phot. Conch., 1863, pl. II, fig. 10.

Margaron (Unio) prevostianus LEA, Syn., 1852, p. 29; 1870, p. 44.

Unio proximus LEA, Pr. Am. Phil Soc., V, 1852, p. 252; Tr. Am. Phil. Soc., X, 1852, p. 271, pl. XX, fig. 27; Obs., V, 1852, p. 27, pl. XX, fig. 27.

Margaron (Unio) proximus LEA, Syn., 1852, p. 29; 1870, p. 45.

Unio tenerus SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 416, pl. LVIII, figs. 5, 8.

A species, which has something of the texture and coloring of members of the *iris* group, but the form of the shell is distinctly that of the *subrostrata* group. It seems to be distributed in the Atlantic, the Gulf and Mississippi drainage areas.

LAMPSILIS CONSTRICTA (Conrad).

Shell rather small and short, subelliptical, subsolid, subcompressed; beaks not elevated, their sculpture evenly doubly-looped ridges; surface nearly smooth or marked with irregular concentric growth lines; rather shining, yellowish-green, or bottle-green, feebly rayed; hinge somewhat solid; there are two pseudocardinals in the left valve and one and a faint second in the right; one straight lateral in the right valve and two in the left; anterior muscle scars separate, somewhat impressed; posterior scars faint; nacre bluish, sometimes purplish in the center, slightly thicker in front. The female shell is pointed behind a little more than midway up from the base, and between this point and the small marsupial swelling the outline is generally a little emarginate. The male shell is often subrhomboid, the posterior point being generally less than midway up from the base.

Length 38, height 26, diam. 15 mm.

James River, Virginia; south to South Carolina; Floyd County, northwest Georgia; northern Alabama; Tennessee.

Type locality, North River, Rockbridge Co., Va.

Unio lienosus var. *constrictus* CONRAD, Monog., X, 1838, p. 91, pl. XLIX, fig. 4.

Unio constrictus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 247.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVII, fig. 464.

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

Lampsilis constrictus SIMPSON, Syn., 1900, p. 551.

Unio genthii LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 85; Jl. Ac. N. Sci. Phila., 1862, p. 57, pl. II, fig. 204; Obs., VIII, 1862, p. 61, pl. II, fig. 204.

Margaron (Unio) genthii LEA, Syn., 1870, p. 41.

There is quite a little difference in the degree of inflation and form of this shell; some specimens are subinflated and others are slightly elongated. It is distinguished from nearly allied forms by the shape of the post-basal swelling which as a rule does not project below the base line of the shell, and

by the emargination behind the swelling. The form found in the Atlantic drainage has generally received the name given by Conrad, while that found in the Tennessee system has been called by Lea's name. A careful examination of a considerable series of shells from both regions convinces me that they are identical.

LAMPSILIS APICINA (Lea).

Shell small, subsolid, smooth, elliptical, rather compressed, nearly equilateral, the posterior point less than half way up from the base, slightly and obliquely truncate above this point; beaks rather full, regularly and beautifully sculptured with fine, doubly-looped ridges; ligament short; epidermis yellowish-brown, covered with small, nearly equidistant rays; pseudo-cardinals small, compressed, two in each valve; laterals delicate, nearly straight, two in the left valve and one in the right; anterior cicatrices distinct, posterior faint; nacre bluish or purplish.

Length 30, height 18, diam. 9 mm.

Type locality, Othcalooga Creek, Gordon County, Georgia.

Unio apicinus LEA, Pr. Ac. N. Sci., Phila., IX, 1857, p. 32; Jl. Ac. N. Sci. Phila., IV, 1858, p. 76, pl. XIV, fig. 56; Obs., VI, 1858, p. 76, pl. XVI, fig. 56.

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

Lampsilis apicinus SIMPSON, Syn., 1900, p. 551.

I have only seen a few specimens of this shell, which is not represented in the Lea collection, the type probably being lost. The specimens I have examined are most likely males, and I cannot be certain as to their relationship, but place the species here provisionally.

LAMPSILIS OCCIDENTALIS (Conrad).

Shell obovate or subrhomboidal, convex, thin or subsolid, rounded in front, bluntly pointed or subbiangulate behind; posterior ridge scarcely developed; beaks slightly elevated, their sculpture not seen, but probably having fine, doubly-looped ridges; epidermis yellowish, yellowish-green or brownish, with numerous more or less distinct rays, mostly on the hinder

part of the shell, slightly shining; left valve with two pseudocardinals, the anterior larger, and two delicate, nearly straight laterals; right valve with two pseudocardinals, the lower larger, and one lateral; nacre bluish-white, tinted with purple in the center, or purplish throughout, scarcely thickened in front. Male shell somewhat rhomboid, the posterior point nearest to the base; female with a long, rather full marsupial swelling, slightly biangulate behind, the biangulation midway up from the base or a little higher.

Length (male) 45, height 23 mm.

Length (female) 40, height 23, diam. 15 mm.

Length (female) 43, height 26, diam. 17 mm.

Current and Little Red Rivers, Arkansas.

Type locality, Current River, Ark.

Unio occidentalis CONRAD, Monog., VII, 1836, p. 64, pl. XXXVI, fig. 1.

Margaron (Unio) occidentalis LEA, Syn., 1852, p. 33; 1870, p. 53.

Lampsilis occidentalis SIMPSON, Syn., 1900, p. 551.

I have seen a half dozen female shells which I presume are the above species, but I have never seen a male shell. The largest specimen is dark and feebly rayed. It is probable that none of them are quite fully grown. These shells are from the Little Red River, Arkansas. They are something like female *L. concestator* or *unicostata*, but are smaller and more delicate.

LAMPSILIS NIGERRIMA (Lea).

Shell obovate, rather thin to subsolid, subcompressed, with a scarcely developed posterior ridge; rounded in front; rounded or feebly bianulate behind; beaks not inflated, sculptured with fine, slightly doubly-looped ridges; surface with irregular growth lines; epidermis greenish-yellow to blackish, when fresh rather dull and cloth-like but becoming smoother and shining when rubbed, sometimes feebly rayed behind; hinge line generally evenly curved; left valve with two compressed pseudocardinals, the anterior higher, and two slightly curved, lamellar laterals; right valve with two pseudocardinals, the lower much

the larger, and one lateral; beak cavities shallow, compressed; muscle scars but slightly impressed; nacre bluish-white, generally dull, with a purplish or brownish center. Both male and female shells are somewhat obovate, the former round posteriorly or slightly biangulate. The female shell is moderately produced at the posterior base, and nearly round behind or having a blunt posterior point two-thirds of the way up from the base.

Length (male) 55, height 35, diam. 17 mm.

Length (female) 55, height 37, diam. 18 mm.

Eastern Texas; east to Enterprise, southeast Alabama; north possibly to southern Indiana.

Type locality, Alexandria, La.

Unio nigerrimus LEA, Tr. Am. Phil. Soc., X, 1852, p. 268, pl. XVIII, fig. 23; Obs., V, 1852, p. 24, pl. XVIII, fig. 23.

Margaron (Unio) nigerrimus LEA, Syn., 1852, p. 31; 1870, p. 49.

Lampsilis nigerrimus SIMPSON, Syn., 1900, p. 551.

Unio fuligo REEVE, Conh. Icon., XVI, 1856, pl. XXX, fig. 159.

This species differs from *L. lienosa* in being thinner, more compressed, more rounded behind, and in being somewhat obovate.

Group of *Lampsilis iris.*

Shell rather small, elliptical, moderately solid in front, thinner behind; epidermis covered with dark green, broken rays, beak sculpture consisting of irregular ridges and corrugations that have a tendency to fall into two loops, which are sometimes slightly nodulous below; nacre bluish, becoming beautifully iridescent posteriorly. Animal having the inner branchiæ free or united to the abdominal sac; mantle border often maculated and generally in the female having papillæ below the marsupium; marsupium having a strong, deep sulcus parallel with or near to the base.

LAMPSILIS IRIS (Lea).

Shell long elliptical or long ovate, inequilateral, subinflated, with a low, rounded posterior ridge; beaks low, compressed, sculptured with very irregular, broken ridges which show a

tendency to be doubly looped; surface covered with rather faint, irregular growth lines, pale yellowish or greenish-yellow, marked with numerous, wide or narrow, broken rays; left valve with two rather stumpy, small pseudocardinals and two small, lamellar laterals; right valve with one pseudocardinal, with usually a very faint, compressed one above it, and one lateral; beak cavities shallow, with a few dorsal scars; muscle scars shallow, the posterior nearly circular; nacre bluish, somewhat iridescent behind, slightly thicker in front. The male shell is nearly evenly long ovate, often ending behind in a slight, narrow biangulation about midway up the shell; the female shell is slightly pointed behind midway up and has a moderate, rounded marsupial swelling, and is generally smaller than that of the male.

Length (male) 65, height 34, diam. 20 mm.

Length (female) 58, height 28, diam. 17 mm.

St. Lawrence drainage; west to southern Michigan; Ohio River system; Illinois and Wisconsin.

Type locality, Ohio.

Unio iris LEA, Tr. Am. Phil. Soc., III, 1830, p 439, pl. XI, fig. 18; Obs., I, 1834, p. 53, pl. XI, fig. 18.—HANLEY, Biv. Shells, 1843, p. 206, pl. XXI, fig. 37.—CHENU, Ill. Conch., 1858, pl. VIII, figs. 7, 7*a*, 7*b*.—REEVE, Conch. Icon., XVI, 1865, pl. XXIX, fig. 148.

Margarita (Unio) iris LEA, Syn., 1836, p. 37; 1838, p. 25.

Margaron (Unio) iris LEA, Syn., 1852, p. 38; 1870, p. 60.

Lampsilis iris BAKER, Moll. Chicago, Pt. I, 1898, p. 105, pl. XIII, fig. 1; pl. XIV, fig. 2.—SIMPSON, Syn., 1900, p. 552.

Eurynia (Micromya) iris ORTMANN, Ann. Car. Mus., VIII, 1912, p. 341, fig. 23.

Unio creperus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 33, pl. X, fig. 28; Obs., II, 1838, p. 33, pl. X, fig. 28.—CHENU, Ill. Conch., 1858, pl. XXIII, figs. 5, 5*a*, 5*b*.

Margarita (Unio) creperus LEA, Syn., 1836, p. 28; 1838, p. 20.

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

Unio cresserus HANLEY, Test. Moll., 1842, p. 196.

Unio novi-eboraci LEA, Tr. Am. Phil. Soc., VI, 1838, p. 104, pl. XXIV, fig. 114; Obs., II, 1838, p. 104, pl. XXIV, fig. 114.—DE KAY, Zool. of N. Y., Pt. 5, 1843, pl. XX, fig. 240.—CHENU, Ill. Conch., 1858, pl. XIX, figs. 5, 5*a*, 5*b*.—KUSTER, Conch. Cab. Unio, 1861, p. 221, pl. LXXIV, fig. 4.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVIII, fig. 206.

Margarita (Unio) novi-eboraci LEA, Syn., 1838, p. 19.

Margaron (Unio) novi-eboraci LEA, Syn., 1852, p. 27; 1870, p. 60.

Unio radiatus DEKAY, Zool. of N. Y., Pt. 5, 1843, p. 189, pl. XVII, fig. 236.

Unio subrostratus KUSTER, Conch. Cab. Unio., 1861, p. 203, pl. LXVII, fig. 3.—REEVE, Conch. Icon., XVI, 1864, pl. XVII, fig. 78.

Some shells are scarcely rayed, having only a few faint, broken splashes of green.

Lea places *Unio opalinus* Anthony (Am. Jl. Conch. II, 1866, p. 145, pl. VII, fig. 2) in the synonymy of the above species. It is an oval, compressed, greenish-yellow shell according to the figure and description, and seems to have been injured anteriorly. I cannot tell what it is. It is credited by Anthony to Michigan.

LAMPSILIS FATUA (Lea).

Shell rather elongated, sometimes long ovate, round before and usually behind, subinflated, subsolid, generally having a rather elevated, but rounded, posterior ridge, with low beaks, which have very irregular, broken, scarcely doubly-looped sculpture; surface covered with fine, irregular growth lines, yellowish-green, feebly or strongly rayed, rays scarcely broken, the posterior end of the shell usually darker than the anterior end; there are two small, sometimes irregular, subcompressed pseudocardinals in the left valve, and two delicate laterals; one pseudocardinal and a vestige of a second in the right valve and one lateral; beak cavities shallow; anterior scars scarcely impressed; posterior scars rather faint; nacre bluish-white, very much thickened in front, richly iridescent behind.

The male shells are sometimes feebly biangulate behind, but are more often rounded. I have only seen two female shells, one of which seems adult and both are much smaller than the shells of the males. They are rounded behind and have a feebly developed marsupial swelling.

Length (male) 68, height 33, diam. 22 mm.

Length (female) 45, height 23, diam. 16 mm.

Tennessee system. Beaver River, Pennsylvania. (?)

Type locality, Holston River, Tenn.

Unio fatuus LEA, Pr. Am. Phil. Soc. I, 1840, p. 287; Tr. Am. Phil. Soc., VIII, 1842, p. 201, pl. XI, fig. 14; Obs., III, 1842, p. 39, pl. XI, fig. 14.—CHENU, Ill. Conch., 1858, pl. XXXI, figs. 4, 4*a*, 4*b*.—KUSTER, Conch. Cab. Unio, 1862, p. 287, pl. XCVI, fig. 5.

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

Lampsilis fatuus SIMPSON, Syn., 1900, p. 553.

Unio dactylus LEA, Pr. Am. Phil. Soc., I, 1840, p. 287; Tr. Am. Phil. Soc., VIII, 1842, p. 196, pl. IX, fig. 7; Obs., III, p. 34, pl. IX, fig. 7.—CHENU, Ill. Conch., 1858, pl. XXX, figs. 5, 5*a*, 5*b*.

Margaron (Unio) dactylus LEA, Syn., 1852, p. 36; 1870, p. 57.

I formerly doubted whether this species was distinct from *L. iris*, but a recent examination of additional material convinces me that, though there are intermediate specimens, it is a valid species. It is generally longer in proportion than *iris*, it has a higher posterior ridge, it is less rayed and the rays are more entire, the posterior part of the shell is darker, the teeth are smaller and the front half of the shell is very much thicker. The thin hinder part of the nacre of *fatua* is beautifully iridescent, with shades of blue and green predominating.

LAMPSILIS PLANICOSTATA (Lea).

Shell long elliptical or slightly rhomboid, subcompressed, scarcely subsolid, with low, compressed beaks that have irregular, doubly-looped sculpture; surface with faint irregular, concentric growth lines, greenish-yellow, with broken, narrow or wide, green rays, which are often somewhat alternately ar-

ranged; left valve with two subcompressed pseudocardinals and two nearly straight, delicate laterals; right valve with one pseudocardinal and a faint one above it, with sometimes a slight tooth behind, and a single lateral; beak cavities shallow, compressed; anterior muscle scars shallow; posterior scars very faint; nacre bluish-white, iridescent behind, slightly thicker in front. Male shell generally a little rhomboid, the posterior point being rarely biangulate and generally not greatly elevated above the base line, though sometimes it is midway up; female shell with a feebly developed, rounded marsupial swelling.

Length 55, height 30, diam. 15 mm.

Warren County, Kentucky; Clinch River, Tennessee; Tuscumbia, Alabama.

Type locality, Tuscumbia, Ala.

Unio planicostatus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 92; Jl. Ac. N. Sci. Phila., IV, 1860, p. 354, pl. LIX, fig. 179; Obs., VIII, 1860, p. 36, pl. LIX, fig. 179..

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

Lampsilis planicostatus SIMPSON, Syn., 1900, p. 553.

I am doubtful whether this is more than a mere variety of *L. iris*. It seems to be generally more compressed and wider behind; the males are more rhomboid as a rule, and the marsupial swelling is less developed than in that species.

LAMPSILIS NEBULOSA (Conrad).

Shell irregularly long elliptical or subrhomboid, subcompressed to subinflated; beaks scarcely full, their sculpture consisting of a few, irregular, slightly doubly-looped ridges; surface with irregular growth lines, greenish-yellow with narrow to wide, generally broken, rays, sometimes almost rayless; left valve with two somewhat compressed pseudocardinals and two nearly straight laterals; right valve with two pseudocardinals, the upper the smaller, and one lateral; beak cavities shallow; posterior scars faint to distinct; nacre bluish-white, sometimes with pinkish or purple center, iridescent and slightly thinner behind. Male shell subrhomboid, the posterior point often

showing feeble traces of biangulation. Female shell somewhat rounded behind, with a faint marsupial swelling, generally smaller than the male.

Length (male) 57, height 32, diam. 16 mm.

Length (male) 52, height 31, diam. 18 mm.

Length (female) 46, height 27, diam. 17 mm.

Cumberland and Tennessee River systems; Green River, Kentucky; Tombigbee and Alabama Rivers drainage; Columbus, Georgia; Wolfsville, North Carolina.

Type locality, Black Warrior River, Ala.

Unio nebulosus CONRAD, New F. W. Shells, 1834, p. 28, pl III, fig. 7; p. 70.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 16, pl. I, fig. 4.

Lampsilis nebulosus SIMPSON, Syn., 1900, p. 553.

Margarita (Unio) cumberlandianus LEA, Syn., 1836, p. 27; 1838, p. 20.

Margaron (Unio) cumberlandianus LEA, Syn., 1852, p. 30.

Unio cumberlandicus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 25, pl. VII, fig. 19; Obs., II, 1838, p. 25, pl. VII, fig. 19.—HANLEY, Biv. Shells, 1843, p. 195, pl. XXII, fig. 59.—CHENU, Ill. Conch., 1858, pl. XXIV, figs. 1, 1*a*, 1*b*.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVI, fig. 197.

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

Unio notatus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 28, pl. VIII, fig. 22; Obs., II, 1838, p. 28, pl. VIII, fig. 22.—HANLEY, Biv. Shells, 1843, p. 193, pl. XXIII, fig. 9.—CHENU, Ill. Conch., 1858, pl. XXI, figs. 3, 3*a*, 3*b*.

Margarita (Unio) notatus LEA, Syn., 1836, p. 26; 1838, p. 19.

Margaron (Unio) notatus LEA, Syn., 1852, p. 29; 1870, p. 45.

Unio glaber LEA, Tr. Am. Phil. Soc., VI, 1838, p. 34, pl. X, fig. 29; Obs., II, 1838, p. 34, pl. X, fig. 29.—HANLEY, Biv. Shells, 1843, p. 196, pl. XXIII, fig. 2.—CHENU, Ill. Conch., 1858, pl. XXIV, figs. 3, 3*a*, 3*b*.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXV, fig. 452.

Margarita (Unio) glaber LEA, Syn., 1836, p. 28; 1838, p. 20.

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

Unio radians LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 32; Jl. Ac. N. Sci. Phila., IV, 1859, p. 201, pl. XXIII, fig. 84; Obs., VII, 1859, p. 19, pl. XXIII, fig. 84.

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

Unio jonesii LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 171; Jl. Ac. N. Sci. Phila., IV, 1860, p. 339, pl. LIV, fig. 164; Obs., VIII, 1860, p. 21, pl. LIV, fig. 164.

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

Unio discrepans LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 92; Jl. Ac. N. Sci. Phila., IV, 1860, p. 340, pl. LV, fig. 165; Obs., VIII, 1860, p. 22, pl. LV, fig. 165.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIV, fig. 176.

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

Unio scitulus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 93; Jl. Ac. N. Sci. Phila., IV, 1860, p. 342, pl. LV, fig. 167; Obs., VIII, 1860, p. 24, pl. LV, fig. 167.

Margaron (Unio) scitulus LEA, Syn., 1870, p. 45.

Unio linguæformis LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 305; Jl. Ac. N. Sci. Phila., IV, 1860, p. 345, pl. LVI, fig. 170; Obs., VIII, 1860, p. 27, pl. LVI, fig. 170.

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

Unio perpictus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 306; Jl. Ac. N. Sci. Phila., IV, 1860, p. 350, pl. LVIII, fig. 175; Obs., VIII, 1860, p. 32, pl. LVIII, fig. 175.

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

Unio sparus LEA, Pr. Ac. N. Sci. Phila., XX, 1868, p. 143; Jl. Ac. N. Sci. Phila., VI, 1868, p. 306, pl. XLVII, fig. 119; Obs., XII, p. 66, pl. XLVII, fig. 119.

Margaron (Unio) sparus LEA, Syn., 1870, p. 45.

Unio subrostratus KUSTER, Conch. Cab. Unio, 1861, p. 203, pl. LXVIII, fig. 1.

I have united a number of nominal species under this, which seems to be the oldest name. Conrad's figure of *U. nebulosus* in the New Fresh Water Shells well represents a male specimen of Lea's *cumberlandicus* and a number of other so-called species. Conrad states that his shell is thin, while a majority of the

specimens are subsolid, but it is often rather fragile. *Unio difficilis* Lea, placed in the synonomy of *nebulosa* in the Synopsis, may be a form of *L. planca* Lea.

LAMPSILIS MÜHLFELDIANA (Lea).

Shell irregularly long elliptical, solid in front, thin behind, scarcely subinflated, with low, compressed beaks sculptured beautifully with numerous, somewhat irregularly doubly-looped ridges; surface with rather rude growth lines; dirty greenish-yellow with a few faint rays; there is a slight elevation extending from the beaks to a point on the base one-third of the distance from the posterior end, and from this point to the somewhat elevated posterior end the shell is somewhat truncated; left valve with two roughened, equal pseudocardinals and two lamellar laterals; right valve with one pseudocardinal and one lateral; muscle scars distinct; nacre whitish, shaded salmon in the cavity, iridescent behind.

Length 60, height 34, diam. 20 mm.

Type locality, Cumberland River, Tenn. Also, Watauga River near Johnson City, Tenn.

Unio mühlfeldianus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 41, pl. XII, fig. 36; Obs., II, 1838, p. 41, pl. XII, fig. 36.—HANLEY, Biv. Shells, 1843, p. 196, pl. XXII, fig. 60.—CHENU, Ill. Conch., 1858, pl. XVII, figs. 5, 5*a*, 5*b*.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVIII, fig. 211.

Margarita (Unio) mühlfeldianus LEA, Syn., 1836, p. 27; 1838, p. 20.

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

Lampsilis mühlfeldianus SIMPSON, Syn., 1900, p. 555.

I have only seen a single specimen of this, the type, and I am doubtful whether it is a valid species, yet I cannot refer it to any other. Its coloration is something like that of adult specimens of *L. zieglcriana*, but the shell is differently shaped, being somewhat truncated at the posterior base.

LAMPSILIS AMŒNA (Lea).

Shell long elliptical, the dorsal and ventral lines nearly parallel, having the anterior and posterior ends rounded, subsolid, subinflated, without a dorsal ridge; beaks low, their sculpture not seen, growth lines irregular; surface greenish-yellow, more or less wavy-rayed; left valve with two equal, rather small pseudocardinals and two laterals; right valve with one pseudocardinal, with a faint second one above it, and one lateral; muscle scars well impressed; nacre bluish-white, silvery, sometimes dark in the center, much thinner and iridescent behind. Female shell apparently smaller than the male, and more evenly rounded behind, straight or very slightly incurved along the base in front of the moderately developed, rounded marsupial swelling.

Length (male) 60, height 35, diam. 20 mm.

Length (female) 50, height 27, diam. 16 mm.

Type locality, Holston River, Tennessee.

Unio amœnus LEA, Pr. Am. Phil. Soc., I, 1840, p. 286; Tr. Am. Phil. Soc., VIII, 1842, p. 200, pl. x, fig. 12; Obs., III, 1842, p. 38, pl. x, fig. 12.—HANLEY, Biv. Shells, 1856, p. 386, pl. XXIV, fig. 9.—CHENU, Ill. Conch., 1858, pl. XXXIII, figs. 5, 5*a*, 5*b*.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIX, fig. 416.

Margaron (Unio) amœnus LEA, Syn., 1852, p. 29; 1870, p. 45.

Lampsilis amœnus SIMPSON, Syn., 1900, p. 555.

I am not certain that this is more than a variety of *L. nebulosa*, but it is more oblong, the ends being nearly evenly rounded, while *nebulosa* is pointed behind.

LAMPSILIS TENERA (Lea)

Shell long elliptical or slightly obovate, subcompressed, subsolid, feebly biangulate and showing a nearly evenly rounded outline behind; beaks low but utterly eroded away in all the specimens seen; surface with irregular growth lines, dirty greenish-yellow or tawny, with a few faint rays, sometimes almost rayless; left valve with two small pseudocardinals and two delicate laterals; right valve with one pseudocardinal and

one lateral; muscle scars shallow; nacre dirty and livid. The male and female shells seem to differ but little, the latter apparently have a faint marsupial swelling.

Length 60, height 35, diam. 17 mm.

Type locality, Big Pigeon River, Tenn. Also, French Broad River, Tenn.; near Bowling Green, Kentucky.

Unio tener LEA, Pr. Am. Phil. Soc., I, 1840, p. 286; Tr. Am. Phil. Soc., VIII, 1840, p. 198, pl. x, fig. 10; Obs., III, 1842, p. 36, pl. x, fig. 10.—CHENU, Ill. Conch., 1858, pl. XXXI, figs. 1, 1*a*, 1*b*.

Margaron (Unio) tener LEA, Syn., 1852, p. 28; 1870, p. 44.

Lampsilis tener SIMPSON, Syn., 1900, p. 555.

Unio regularis LEA, Pr. Am. Phil. Soc., II, 1841, p. 82; Tr. Am. Phil. Soc., VIII, 1842, p. 243, pl. XXV, fig. 59; Obs., III, 1842, p. 81, pl. XXV, fig. 59.—CHENU, Ill. Conch., 1858, pl. XXXIII, figs. 3, 3*a*, 3*b*.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXVIII, fig. 351.

Margaron (Unio) regularis LEA, Syn., 1852, p. 29; 1870, p. 45.

Lea's *Unio tener* is represented in his collection by only a single broken shell, which I have no hesitation in saying is identical with his *U. regularis*, of which he has two very badly eroded specimens.

LAMPSILIS SIMA (Lea).

Shell oval or elliptical, not inflated, solid, with low, compressed beaks, which are sculptured with irregular, somewhat doubly-looped ridges; posterior ridge low and rounded; surface rudely and irregularly concentrically striate in old specimens, smoother in young shells, yellowish-green, greenish-yellow or tawny, with numerous wavy rays, often shining in well-preserved shells; left valve with two stumpy pseudocardinals and two short laterals; right valve with one pseudocardinal and a feeble one above it, with one lateral; beak cavities shallow, showing a few dorsal pits; muscle scars well marked; pallial line well impressed in front; nacre pinkish or purple, sometimes bluish-white, with a darker center, thickened in front, iridescent behind. The male shell is somewhat oval, sometimes being

slightly produced at the anterior base, and occasionally straight on the basal line. All the female shells seen are smaller than the males; they are shaped much like those of the males but are a little fuller at the post-base.

Length (male) 52, height 30, diam. 19 mm.

Length (female) 38, height 23, diam. 14 mm.

Cumberland and Tennessee River systems; Othcalooga Creek, northwest Georgia.

Type locality, Cumberland River, Tenn.

Margarita (Unio) simus LEA, Syn., 1836, p. 29; 1838, p. 21.

Unio simus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 26, pl. VIII, fig. 20; Obs., II, 1838, p. 26, pl. VIII, fig. 20.—CHENU, Ill. Conch., 1858, pl. XXI, figs. 4, 4*a*, 4*b*.—KUSTER, Conch., Cab. Unio, 1861, p. 248, pl. LXXXIII, fig. 4; p. 262, pl. LXXXVIII, fig. 3.

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

Lampsilis simus SIMPSON, Syn., 1900, p. 556.

Unio notatus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 253.

Unio spatulatus SOWERBY, Conch. Icon., XVI, 1868, pl. LXV, fig. 328.

? Unio proximus KUSTER, Conch. Cab. Unio, 1861, p. 248, pl. LXXXIII, fig. 4.

This species seems to combine characters of the *ellipsiformis* and the *iris* groups. Its solidity and form are characters of the former group, though the young shells are shaped like young *nebulosa*, while the beak sculpture and color pattern are those of the *iris* group.

LAMPSILIS PLANCA (Lea).

Shell irregularly obovate, subinflated, subsolid, with a well-developed, somewhat rounded posterior ridge; beaks rather full but not high, their sculpture not seen; surface rather smooth and shining, dirty greenish-yellow or dirty tawny, with a few wide or narrow, faint, often broken rays; left valve with two small, stumpy pseudocardinals and two short laterals; right valve with one pseudocardinal, sometimes with a vestige of one above it, and one lateral; muscle scars well marked; beak cavities shallow; nacre bluish-white, lurid in the center.

Both male and female shells are wider behind, but the male shell is somewhat rhomboid, the somewhat biangulate posterior point being near the base of the shell. The posterior end of the female shell is usually faintly biangulate, but it is placed rather higher than in the male and the post-basal swelling is but feebly developed. The female shell is higher than that of the male.

Length (male) 42, height 27, diam. 16 mm.

Length (female) 42, height 30, diam. 16 mm.

Type locality, Coosa River at Wetumpka, Alabama.

Unio plancus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 307; Jl. Ac. N. Sci. Phila., V, 1862, p. 81, pl. x, fig. 229; Obs., VIII, 1862, p. 85, pl. x, fig. 229.

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

Lampsilis plancus SIMPSON, Syn., 1900, p. 556.

Unio difficilis LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 144; Jl. Ac. N. Sci. Phila., VI, 1869, p. 311, pl. XLIX, fig. 124; Obs., XII, 1869, p. 71, pl. XLIX, fig. 124.

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

I am doubtful whether this is more than a rather short, somewhat rhomboid variety of *L. nebulosa* with a well-developed posterior ridge. The female shell, however, seems to differ in shape from that of *nebulosa*.

Group of *Lampsilis subangulata*.

Shell elliptical, inflated, subsolid, drawn to a point behind; that of the female only slightly swollen just behind the central base; bars of the beak sculpture somewhat coarse, feebly double looped; epidermis very smooth, shining, brightly rayed; teeth rather smooth, subcompressed; nacre bluish or purplish. Animal having the marsupium very large; ovisacs numerous; gills large, nearly semicircular.

LAMPSILIS SUBANGULATA (Lea).

Shell long elliptical or long ovate, rather solid, subinflated, with full, but not high, beaks, the sculpture not seen; posterior ridge well developed, slightly rounded; anterior end round;

base line curved, a little fuller behind the center of the shell; the posterior end drawn out into a rounded or slightly biangulate point about midway up from the base; surface, when in good condition, smooth and brilliant, tawny or pale greenish-yellow, distinctly marked with usually broad, green rays; left valve with two small, low, slightly compressed pseudocardinals and two short laterals; right valve with two pseudocardinals, the upper small and compressed, and one lateral; beak cavities not deep, but compressed; muscle scars impressed, the anterior separate; nacre bluish-white, lurid, pinkish-salmon or purplish, but slightly thickened in front. The male and female shells differ little, the latter is slightly more produced behind the center of the base than the former.

Length 57, height 33, diam. 20 mm.

Appalachicola River system, Georgia and Florida.

Type locality, Chattahoochee River, Columbus, Ga.

Unio subangulatus LEA, Pr. Am. Phil. Soc., I, 1840, p. 287; Tr. Am. Phil. Soc., VIII, 1842, p. 29, pl. XIII, fig. 23; Obs., III, 1842, p. 47, pl. XIII, fig. 23.—CHENU, Ill. Conch., 1858, pl. XXIX, figs. 2, *2a*, *2b*.—KUSTER, Conch. Cab. Unio, 1862, p. 278, pl. XCIV, fig. 2.—SIMPSON, Pr. U. S. N. Mus., XVI, 1892, p. 415, pl. LVIII, fig. 1.

Margaron (Unio) subangulatus LEA, Syn., 1852, p. 29; 1870, p. 45.

Lampsilis subangulatus SIMPSON, Syn., 1900, p. 556.

Unio fasciolus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 249.

A brilliant and beautiful shell when in perfect condition. In fine specimens the rays are broad and distinct; there are sometimes intermediate narrow ones, and all are a rich green. Occasional specimens are nearly or quite rayless.

LAMPSILIS KIRKLANDIANA (S. H. Wright).

Shell elliptical or elliptic ovate, subsolid, subinflated, with full, rather high beaks, whose sculpture in the only specimen examined is eroded, with a high, but rounded, posterior ridge, which ends in a decided, drawn-out, rounded point about midway up the height of the shell; base line rounded, but slightly

fuller just behind the center; surface perfectly smooth except for rest lines, color greenish-yellow with beautiful broad, rich green rays throughout; between these broad rays there are narrower and fainter ones; epidermis polished and very brilliant, wrinkled on the posterior slope; ligament short and high; left valve with three small, rather blurred, subcompressed pseudocardinals and two remote, short laterals, the hinge plate between the two sets of teeth narrowed and rounded; right valve with two pseudocardinals, the lower the larger, and a short, remote, high lateral. Beak cavities moderate; muscle scars shallow; nacre bluish-white, not brilliant, slightly iridescent behind. The type is probably a male shell, though in this group there seems to be but little difference between the shells of the two sexes.

Length 48, height 28, diam. 19 mm.

Type locality, Ocklocknee River, Leon County, Florida.

Unio kirklandianus S. H. Wright, Naut., X, 1897, p. 136.

Lampsilis kirklandianus Simpson, Pr. Ac. N. Sci. Phila., 1900, p. 76, pl. 1, fig. 7; Syn., 1900, p. 557.

One of the loveliest Naiades in the world. The color pattern is exquisite, and the epidermis is more highly polished than in any Unione I know of. It closely resembles the brighter forms of *subangulata,* but it is much smoother and more brilliant, it has a higher posterior ridge, and feebler, more compressed pseudocardinals.

Group of *Lampsilis ellipsiformis.*

Shell elliptical, subinflated, pointed behind, that of the female but slightly swollen at the post-base; behind this inflation there is a slight sinus; beak sculpture doubly looped, the hinder loop sometimes open behind; epidermis dull, rayed with wavy lines, generally arranged in bands; nacre white.

Animal with the marsupium colored below; gills large, inner wholly united to or only free from the abdominal sac a short distance.

LAMPSILIS ELLIPSIFORMIS (Conrad).

Shell long elliptical or long ovate, subinflated, generally quite solid, sometimes very heavy, with a moderately rounded posterior ridge; beaks low, often flattened, lunule elongated, passing back under the beaks; anterior end rounded; posterior end drawn out to a dull, rounded or biangulate point about midway up from the base; base line rounded, often a little fuller just behind the middle, and between this and the post-point the outline is sometimes a little incurved; surface with rude, irregular growth lines, greenish-yellow, or yellowish-green with numerous wavy, faint rays, often showing feeble, concentric bands or clouds of green. In front of the posterior ridge there are frequently deep, irregular, radiating grooves and sometimes finer and more regular radiating ones; epidermis often cloth-like, lusterless. There is little difference between the male and female shell, the latter being a trifle more produced behind the center of the base; pseudocardinals two in the left valve and one and a vestige of a second in the right, small, stumpy; laterals short, rather heavy; muscle scars deep; beak cavities very shallow, with a few pits; nacre bluish-white or flesh-colored, thicker in front, with a posterior, radial furrow.

Length 72, height 42, diam. 28 mm.

Length 85, height 45, diam. 34 mm.

Upper Mississippi Valley generally; south to about latitude 38°; western New York; southern Michigan; southern Canada; Red River of the North.

Type locality, Michigan.

Unio ellipsiformis CONRAD, Monog., VIII, 1836, p. 60, pl. XXXIV, fig. 1.

Lampsilis ellipsiformis SIMPSON, Syn., 1900, p. 557.

Unio spatulatus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164; Tr. Am. Phil. Soc., X, 1848, p. 80, pl. VIII, fig. 22; Obs., IV, 1848, p. 54, pl. VIII, fig. 22.—KUSTER, Conch. Cab. Unio, 1861, p. 261, pl. LXXXVII, fig. 7.

Margaron (Unio) spatulatus LEA, Syn., 1852, p. 28; 1870, p. 43.

Lampsilis spatulatus BAKER, Moll, Chicago, Pt. I, 1898, p. 106, pl. X, fig. 5; XIII, fig. 2.

This species sometimes exceeds the above dimensions and is occasionally one of the most ponderous of North American Uniones. Other specimens, in unfavorable conditions, no doubt, do not exceed a length of 35 to 40 millimeters and are rather thin.

LAMPSILIS PLEASII (Marsh).

Shell small, long elliptical, subcompressed, scarcely subsolid, with low beaks, their sculpture not seen; growth lines irregular; surface dirty tawny with numerous close, narrow, wavy rays, the whole dull colored and somewhat cloth-like; posterior ridge low, rounded; left valve with two irregular, somewhat compressed pseudocardinals and two rather feeble, short laterals; right valve with one pseudocardinal, a faint one above it, and one lateral; beak cavities shallow, with a few deep pits; anterior scars separate; nacre lurid greenish, bluish or brownish, slightly thickened in front. The shells of this species are somewhat drawn out behind and bluntly pointed about midway up from the base. The base line is rounded and a little full just behind the center; that of the female differs but little from the male, it being slightly more produced in the region of the marsupium.

Length 40, height 23, diam. 13 mm.

Type locality, Little Red River, Arkansas. Also, Morrisville, Polk County, Missouri.

Unio pleasii MARSH, the Observer (a newspaper), II, May, 1891; Nautilus V, 1891, p. 2.

Lampsilis pleasii SIMPSON, Syn., 1900, p. 557.

All the specimens I have seen of this little species are in rather bad condition, being greatly eroded. I cannot be certain as to what the alliances are, but presume that it is related to *L. ellipsiformis*. It is smaller, more delicate and thin than that species, and the nacre is quite different.

LAMPSILIS ARKANSASENSIS (Lea).

Shell ovate, subsolid, subinflated with a low, almost double posterior ridge, which ends in a slight biangulation behind about midway up from the base; above this posterior point

there is a slight oblique truncation and at the posterior end of the ligament there is an angle; the central base is full and from this point to the posterior end the outline is a little incurved; beaks probably only moderately full, in the only specimen seen much eroded: surface irregularly concentrically striate, greenish-tawny with very faint wavy rays behind; left valve with two nearly equal, small, biangular pseudocardinals and two short, club-shaped laterals; right valve with two pseudocardinals, the upper small and compressed, with one lateral and a vestige of another below it; beak cavities not deep, compressed, with several small scars; muscle scars well impressed; nacre silvery with a faint reddish or brownish tint, iridescent behind, slightly thicker in front; pallial line well marked, crenate.

Length 40, height 28, diam. 18 mm.

Type locality, Hot Springs, Arkansas. Also, Saline River, near Benton, Arkansas. (Call.)

Unio arkansasensis LEA, Pr. Ac. N. Sci. Phila., VI, 1862, p. 169; Jl. Ac. N. Sci. Phila., V, 1862, p. 206, pl. XXX, fig. 275; Obs., IX, 1863, p. 28, pl. XXX, fig. 275.

Lampsilis arkansasensis SIMPSON, Syn., 1900, p. 557.

I have seen only one specimen that I feel sure is this shell, the type, and this is apparently a male shell. The whole umbonal region is badly eroded, and it is not in the best condition generally, yet I know of nothing it can be referred to. It seems to be a member of the *ellipsiformis* group.

Group of *Lampsilis ozarkensis*.

Shell elliptical, rather solid, subcompressed, with low beaks slightly biangulate behind and showing the rest periods quite plainly. Pseudocardinals subcompressed; laterals rather long, extended forward to near the pseudocardinals, the groove between the two in the left valve extending forward behind the pseudocardinals and filled with epidermal matter; nacre whitish-silvery; male and female shells but slightly different.

LAMPSILIS OZARKENSIS (Call).

Shell elliptical, rather solid, not inflated, with a low, rounded posterior ridge, sometimes feebly doubly ridged; beaks low, their sculpture not seen; anterior end rounded; posterior end slightly produced, ending in a rounded or slightly biangulate point a little below the middle of the height of the shell; base rounded, a very little fuller behind the center; surface dirty yellowish-green, faintly wavy-rayed or rayless, showing numerous rest periods; epidermis somewhat cloth-like and dull; left valve with two stumpy or slightly compressed pseudocardinals, which are nearly equal in size, and two slightly curved laterals; right valve with one pseudocardinal and a very small tubercle above it, with one lateral, which has a slight ridge along its lower base; beak cavities shallow, compressed; muscle scars well marked; nacre bluish-white, silvery, with a reddish iridescence behind. Male shell feebly biangulate behind, slightly rhomboid, rounded or scarcely biangulate at the post-basal termination, in front of which there is a slight incurving of the base line. Female shell subbiangulate behind, the termination about midway up from the base; marsupial swelling small, long and rounded, not close to the posterior end.

Length 44, height 28, diam. 16 mm.

Type locality, Current River and its tributaries, Jack's Fork and Big Creek, Shannon County, Mo. Also, White River, Ark.

Unio ozarkensis CALL, Pr. U. S. N. Mus., X, 1887, p. 498, pl. XXVII; Tr. Ac. Sci., St. Louis, VII, 1895, p. 33, pl. XVIII.

Lampsilis ozarkensis SIMPSON, Syn., 1900, p. 557.

This species seems to stand somewhat by itself, though it has evident relations with the *trabalis* and *ellipsiformis* groups in its general form and color pattern.

Group of *Lampsilis trabalis*.

Shell solid, that of the male sinuate at post-base, and sometimes produced posteriorly, female shell wider, but slightly sinuous; beak sculpture rather coarse, feebly doubly looped; epidermis dark, with wavy capillary rays; hinge heavy; nacre bluish-white or purple; animal unknown.

LAMPSILIS TRABALIS (Conrad).

Shell solid, inflated, quite inequilateral, irregularly oval, with full, rather high beaks, which are turned forward and sculptured with a few coarse, doubly-looped ridges; lunule small, passing backward and filled with epidermal matter; posterior ridge somewhat full, rounded; surface with irregular growth lines, dirty olive-green, with numerous faint, wavy rays; left valve with two solid, triangular pseudocardinals and two long, straight, club-shaped laterals, the groove between them extending to the epidermal matter of the hinge; right valve with three pseudocardinals, the central one solid and triangular, the others small, and one lateral with a vestige of a second below it; beak cavities shallow, showing a few dorsal scars; muscle scars deep; nacre white or bluish-white with bluish or greenish iridescence behind, much thicker in front. The male and female shells differ remarkably, the former being narrowed about at the center and drawn out behind into a sort of beak. This elongation is obliquely truncated above behind and ends in a rounded point below, the base line being generally a little incurved; the female shell is higher, more nearly evenly ovate, slightly truncate behind above, and has the base line rather evenly curved.

Length (male) 50, height 27, diam. 19 mm.

Length (female) 54, height 35, diam. 25 mm.

Kentucky and streams of Tennessee; Clinch River, Virginia. Type locality, not given.

Unio trabalis CONRAD, New F. W. Shells, May 3, 1834, p. 27, pl. III, fig. 5; p. 72; Monog., XII, 1840, p. 110, pl. LX, fig. 2, —CHENU, Bib. Conch., 1st ser., III, 1845, p. 15, pl. II, fig. 3.

Lampsilis trabalis SIMPSON, Syn., 1900, p. 558.

Eurynia (Micromya) trabalis ORTMANN, Ann. Car. Mus., VIII, 1912, p. 340.

Unio troostensis LEA, Tr. Am. Phil. Soc., V, 1834 (August or September), p. 71, pl. x, fig. 30; Obs., I, 1834, p. 183, pl. x, fig. 30.—HANLEY, Biv. Shells, 1843, p. 186, pl. XXIII, fig. 24.—KUSTER, Conch. Cab. Unio, 1861, p. 193, pl. LXI, fig. 4. —SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVIII, fig. 406.

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

Margaron (Unio) troostensis LEA, Syn., 1852, p. 25.

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

Unio troostii B. H. WRIGHT, Check List, 1888.

Unio vanuxemensis SOWERBY, Conch. Icon., 1866, pl. XXXIX, fig. 216.

A remarkable species, in which the form of the male shell is like that of the female until it is about half grown, when for some reason it begins to be constricted just behind the middle base and becomes much produced behind when adult.

LAMPSILIS PERPURPUREA (Lea).

Shell elongate oval or subrhomboid, scarcely inflated, sometimes subcompressed, rather solid, beaks in all the specimens seen so badly eroded that no characters could be made out, but probably not very full or high; surface with irregular growth lines, dark brownish or blackish, darker behind, with feeble, narrow, wavy rays, which show plainly by transmitted light; left valve with two triangular pseudocardinals and two short, straight laterals; left valve with three pseudocardinals, the central one strong, the others faint, and one lateral with sometimes a furrow on its lower face; beak cavities shallow, showing two or three deep pits; muscle scars impressed; nacre deep purple, iridescent behind. The male and female shells differ considerably, but not so much as in *L. trabalis*. The male shell is somewhat drawn out behind and is straight or slightly incurved on the base; the female shell is irregularly long ovate, faintly incurved behind the feeble marsupial swelling.

Length (male) 52, height 27, diam. 16 mm.

Length (female) 55, height 31, diam. 18 mm.

Tennessee River drainage, extending into Virginia in the Clinch.

Type locality, Tennessee.

Unio perpurpureus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 41; Jl. Ac. N. Sci. Phila., VI, 1866, p. 46, pl. XVI, fig. 44; Obs., XI, 1867, p. 50, pl. XVI, fig. 44.

Margaron (Unio) perpurpureus LEA, Syn., 1870, p. 48.
Lampsilis perpurpureus SIMPSON, Syn., 1900, p. 558.
Unio troostensis SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIX, fig. 415.

Very closely related to *L. trabalis,* and is sometimes a little difficult to determine badly eroded shells. *L. perpurpurea* seems to be thinner, more compressed, and less exaggerated in its peculiar characters than *trabalis.*

Group of *Lampsilis modioliformis.*

Shell elliptical, thin, quite evenly rounded before and behind, somewhat inflated; beak sculpture consisting of a few parallel bars, looped in front, and generally open; epidermis with beautiful, rather broad, generally unbroken, sometimes slightly wavy rays; nacre brilliantly iridescent posteriorly; teeth compressed. The female shell is greatly expanded posteriorly, the outline sometimes being almost arcuate on the middle base, and sweeping around in a regular curve to the ligament. Animal with mantle border often spotted, and in the female furnished with fine, well-developed papillæ on the post-ventral region; branchial opening large, with many strong papillæ; marsupium projecting greatly below the rest of the gills, rounded below; ovisacs large and distinct.

LAMPSILIS MODIOLIFORMIS (Lea).

Shell long elliptical or long obovate, thin, somewhat inflated, with full, but not high, beaks, which are sculptured with numerous rather fine, doubly-looped ridges, the hinder loop somewhat angular below; surface rather smooth and shining, olive or yellowish-green, faintly rayed or almost rayless; left valve with two greatly compressed pseudocardinals, the anterior triangular and much the higher, and two very delicate laterals; right valve with one pseudocardinal and sometimes a faint one above it, with one lateral; beak cavities shallow; muscle scars scarcely impressed, the anterior separate; nacre bluish-white, often tinted with purple, iridescent behind. Male shell long elliptical, sometimes slightly wider and bluntly pointed or

feebly biangulate posteriorly about midway up; female shell much narrower in front, considerably expanded behind where it is widely rounded.

Length (male) 62, height 32, diam. 25 mm.

Length (female) 70, height 37, diam. 25 mm.

Santee Canal, South Carolina, south to north Florida; probably west to Mississippi.

Type locality, Santee Canal, S. C.

Unio modioliformis LEA, Tr. Am. Phil. Soc., V, 1834, p. 97, pl. XIII, fig. 40; Obs., I, 1834, p. 209, pl. XIII, fig. 40.—HANLEY, Biv. Shells, 1843, p. 209, pl. XXIII, fig. 37.—CHENU, Man., 1859, II, p. 139, fig. 678.—SIMPSON, Pr. U. S. N. Mus., XV, 1892, p. 414, pl. LVI, figs. 2, 3, 6.

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

Margaron (Unio) modioliformis LEA, Syn., 1852, p. 39; 1870, p. 44.

Lampsilis modioliformis SIMPSON, Syn., 1900, p. 559.

Unio tenerus RAVENEL, Cat., 1834, p. 58.

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

Margaron (Unio) tenerus LEA, Syn., 1852, p. 39; 1870, p. 44.

Unio delumbis KUSTER, Conch. Cab., 1861, p. 207, pl. LXIX, fig. 1.

Doubtfully distinct from *L. vibex*, though it is generally thinner, more inflated, less rayed, and the female shell is broader behind. Some of the young shells can scarcely be separated from the young of *L. vibex*, and I have seen occasional old specimens that were very hard to place. All the valid specimens I have seen are from the Santee Canal, South Carolina.

LAMPSILIS GRACILIOR (Lea).

Shell elliptical or obovate, thin, scarcely subinflated; beaks not full or high, their sculpture not seen; posterior ridge almost wanting; surface with somewhat irregular growth lines, but rather smooth and shining, often showing the rest periods quite plainly, olive-brown, or olive-green, feebly rayed or nearly rayless; left valve with two compressed pseudocardinals, the

front one higher and larger, and two almost straight, delicate laterals; right valve with a single pseudocardinal and a vestige of one above it, with one lateral; beak cavities not deep; anterior scars shallow, posterior scars scarcely visible; nacre bluish-white, often brownish or purplish in the center, iridescent behind. The male shell is very slightly rhomboid, sometimes feebly biangulate posteriorly, but generally rounded; the female is scarcely produced at the post-basal region and is round behind.

Length (male) 50, height 28, diam. 16 mm.

Length (female) 48, height 29, diam. 15 mm.

Type locality, Buckhead Creek and Tobesaufke Creek, Macon, Ga.

Unio gracilior LEA, Pr. Ac. N. Sci. Phil., VIII, 1856, p. 262.

Unio gracillior LEA, Jl. Ac. N. Sci. Phila., IV, 1858, p. 56, pl. VIII, fig. 38; Obs., VI, 1858, p. 56, pl. VIII, fig. 38.

Margaron (Unio) gracilior LEA, Syn., 1870, p. 45.

Lampsilis gracilior SIMPSON, Syn., 1900, p. 559.

Unio obfuscus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 172; Jl. Ac. N. Sci. Phila., IV, 1859, p. 197, pl. XXII, fig. 80; Obs., VII, 1859, p. 15, pl. XXII, fig. 80.

Margaron (Unio) obfuscus LEA, Syn., 1870, p. 45.

Close to *L. vibex*, but generally thinner, smaller, less rayed and more delicate.

LAMPSILIS VIBEX (Conrad).

Shell varying from thin to subsolid, and from subcompressed to considerably inflated, long elliptical or long obovate; beaks scarcely inflated or elevated, sculptured with a few doubly-looped ridges; growth lines irregular, often slightly sulcate; surface smooth and shining, tawny or greenish-yellow, usually having wide, wavy rays, which may cover the entire shell or only the posterior part of it, occasionally nearly rayless; left valve with two somewhat compressed pseudocardinals, the anterior the higher and longer, and two delicate, rather short laterals; right valve with one pseudocardinal and a vestigial

one above it, with one lateral; beak cavities not deep; muscle scars shallow; nacre bluish-white, slightly iridescent behind. Male shell sometimes sub-rhomboid, occasionally bluntly pointed behind about midway up from the base, often nearly evenly rounded posteriorly; female shell very slightly inflated at the post-basal part and evenly rounded behind.

Length (male) 82, height 45, diam. 32 mm.

Length (female) 74, height 43, diam. 27 mm.

Ogeechee River, Georgia, west to Jackson, Mississippi.

Type locality, Black Warrior River, south of Blount Springs, Ala.

Unio vibex CONRAD, New F. W. Shells, 1834, p. 31, pl. IV, fig. 3; p. 72.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 17, pl. III, fig. 6.

Margarita (Unio) vibex LEA, Syn., 1836, p. 27; 1838, p. 20.

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

Lampsilis vibex SIMPSON, Syn., 1900, p. 559.

Eurynia (Micromya) vibex ORTMANN, Ann. Car. Mus., VIII, 1912, p. 340.

Unio exiguus LEA, Pr. Am. Phil. Soc., I, 1840, p. 287.—Tr. Am. Phil. Soc., VIII, 1842, p. 191, pl. VII, fig. 1; Obs., III, 1842, p. 29, pl. VII, fig. 1.—CHENU, Ill. Conch., 1858, pl. XXX, figs. 1, 1*a*, 1*b*.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVIII, fig. 208.

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

Unio stagnalis CONRAD, Ann. and Mag. N. Hist., IV, 1849, p. 300; Jl. Ac. N. Sci. Phila., I, 1850, p. 275, pl. XXXVII, fig. 2.

Margaron (Unio) stagnalis LEA, Syn., 1852, p. 27; 1870, p. 42.

Unio rutilans LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 262; Jl. Ac. N. Sci. Phila., IV, 1858, p. 59, pl. IX, fig. 41; Obs., VI, 1858, p. 59, pl. IX, fig. 41.—KUSTER, Conch. Cab. Unio, 1861, p. 258, pl. LXXXVII, fig. 3.

Margaron (Unio) rutilans LEA, Syn., 1870, p. 45.

Unio subellipsis LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 262; Jl. Ac. N. Sci. Phila., IV, 1858, p. 62, pl. X, fig. 44; Obs., VI, 1858, p. 62, pl. X, fig. 44.

Margaron (Unio) subellipsis LEA, Syn., 1870, p. 45.

Unio prevostianus SOWERBY, Conch. Icon., XVI, 1868, pl. LXIII, fig. 315.

Unio subangulatus SOWERBY, Conch. Icon., XVI, 1868, pl. LXV, fig. 327.

Var. *nigrina* (Lea).

Shell generally smaller than the typical form, more narrowed in front, thinner, darker colored and less shining. The nacre is coppery or purplish.

Length 55, height 33, diam. 18 mm.

Florida, south to the Hillsborough River.

Type locality, West Florida.

Unio nigrinus LEA, Tr. Am. Phil. Soc., X, 1852, p. 284, pl. XXIV, fig. 44; Obs., V, 1852, p. 40, pl. XXIV, fig. 44.

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

Lampsilis vibex var. *nigrinus* SIMPSON, Syn., 1900, p. 560.

Unio floridensis S. H. WRIGHT, Conch. Exchange, II, 1888, p. 105.

Unio averillii B. H. WRIGHT, Pr. Ac. N. Sci. Phila., XXIII, 1888, p. 115, pl. III, fig. 2.

An abundant, rather widely distributed form and quite variable. Lea's *subellipsis* is generally a little solider and more narrowly rayed than the average forms, but it hardly seems to me to be worthy of a varietal name. I have seen shells from the Cahawba River, Alabama, which are, no doubt, genuine *vibex*, though they are more inflated and pointed behind than specimens found elsewhere, but I do not think they are specifically or even varietally different from *exiguus*, *rutilans* or *subellipsis*.

LAMPSILIS DISPAR (Lea).

Shell long elliptical, scarcely subinflated, subsolid, with a low, rounded posterior ridge; beaks rather low, their sculpture not seen; surface with fine growth striæ, often showing faint, radiating rows of short wrinkles; tawny, pale yellowish or yellowish-green with rather feeble rays on the front part of the shell, but more developed on the hinder part, where they are

sometimes blended together; left valve with two subcompressed pseudocardinals, the anterior much the higher; right valve with two pseudocardinals, the upper very small and lamellar and one lateral; beak cavities shallow, with two or three dorsal pits; nacre whitish, bluish-white, brownish or lurid purplish, scarcely thicker in front. Male shell evenly elliptical or slightly rhomboid, rounded or faintly biangulate behind; female shell rounded behind with only a very small marsupial inflation.

Length 55, height 32, diam. 20 mm.

Southwest Georgia.

Type locality, Columbus, Ga.

Unio dispar LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 305; Jl. Ac. N. Sci. Phila., IV, 1860, p. 327, pl. LI, fig. 153; Obs., VIII, 1860, p. 9, pl. LI, fig. 153.

Margaron (Unio) dispar LEA, Syn., 1870, p. 45.

Lampsilis dispar SIMPSON, Syn., 1900, p. 561.

This species is close to *L. vibex,* but is generally smaller and a little solider, the marsupial swelling is less developed, and it is darker posteriorly than that species.

Group of *Lampsilis amygdalum.*

Shell rather small, obovate, inflated, epidermis varying from smooth and shining to somewhat cloth-like, ashy-green or blackish, but always showing green tints when seen through transmitted light, indistinctly rayed; beaks rather high, sculptured with fine, parallel bars, arranged in a double loop, that in front being large and rounded, that behind small and rather pointed below; hinge teeth compressed; nacre iridescent behind. The greatest height of the shell is just behind the center; its greatest diameter is just in front of it, or at a point just behind the beaks; the posterior end is often pointed and somewhat raised. Animal having the marsupium large, reaching far below the inner gills, and having a black border; inner gills united to the abdominal sac throughout; anal opening smooth or only slightly crenulate.

LAMPSILIS AMYGDALUM (Lea).

Shell elliptical or obovate, somewhat inflated, with full, rather high beaks, which are sculptured with fine, doubly-looped bars; color varying from dirty greenish-white to almost black, with numerous rather faint rays or rayless; epidermis smooth and shining to rather rough, dull and cloth-like; left valve with two elongated, compressed pseudocardinals and two delicate laterals; right valve with one pseudocardinal and a single lateral; beak cavities not deep; muscle scars shallow; nacre bluish-white, creamy or buff-colored, soft and brilliant, richly iridescent behind. The shells are very variable in form and degree of solidity; the males are generally elliptical with a low, rounded posterior ridge, with a slight dorsal wing and a more or less blunt posterior point about midway up from the base. The female shell is usually narrowed and rounded in front, and is almost always darker and rougher than that of the male.

Length 47, height 29, diam. 18 mm.

Florida.

Type locality, Lake George, Fla.

Unio amygdalum LEA. Desc. of twelve sp. Uniones, Aug. 19, 1843; Tr. Am. Phil. Soc., IX, 1846, p. 275, pl. XXXIX, fig. 1; Obs., IV, 1848, p. 33, pl. XXXIX, fig. 1.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 426, pl. LXVII, fig. 3.

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

Lampsilis amygdalum SIMPSON, Syn., 1900, p. 561.

Unio lepidus GOULD, Pr. Bost. Soc. N. Hist., VI, 1856, p. 15; Otia Conch., 1862, p. 222.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 426, pl. LXVIII, fig. 1; pl. LXIX, fig. 3.

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

This is an excessively puzzling form. Generally, but not always, the female shell is darker and rougher than that of the male. The form usually known as *lepidus*, is ordinarily larger and a little more elongated than typical *amygdalum* and it is larger and solider, though I have specimens before me that are

brightly rayed and polished. It seems to so completely blend with *amygdalum* that I cannot make any satisfactory separation. It might however bear Gould's name varietally.

LAMPSILIS SUDA (Lea).

Shell elliptical or slightly obovate, subinflated, scarcely subsolid, beaks nearly central, rather full but not high, their sculpture consisting of a few doubly-looped ridges, the hinder loops somewhat angular below; posterior ridge rather well developed, rounded; surface with irregular, concentric growth lines, shining, tawny or pale brownish with regular, somewhat broken rays; left valve with two compressed peudocardinals, the anterior much higher and triangular, and two delicate, nearly straight laterals; there are two pseudocardinals in the right valve, the lower the larger, and one lateral; beak cavities shallow; nacre bluish-white, rather dull; muscle scars shallow. Male shell elliptical or very feebly subrhomboid, the posterior point midway up from the base or a little less; base much rounded. Female shell wider behind than in front, with a blunt, rounded posterior point two-thirds of the way up from the base, and a small, rounded marsupial swelling situated near the posterior end.

Length 42, height 27, diam. 16 mm.

Type locality, Macon and Dry Creek, near Columbus, Georgia. Also, Abbeville, South Carolina.

Unio concavus LEA, Tr. Am. Phil. Soc., X, 1852, p. 260, pl. XV, fig. 11; Obs., V, 1852, p. 16, pl. XV, fig. 11.—SOWERBY, Conch. Icon., XVI, 1868, pl. XCII, fig. 504.

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

Unio sudus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 170; Jl. Ac. N. Sci. Phila., IV, 1859, p. 194, pl. XXI, fig. 77; Obs., VII, 1859, p. 12, pl. XXI, fig. 77.

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

Lampsilis sudus SIMPSON, Syn., 1900, p. 561.

This seems to be a rare shell, and I have never seen more than half a dozen specimens of it. Of these a single young one is a female and I cannot be certain whether the species

should group here. It differs from *amygdalum* in its color, in having its greatest diameter well towards the posterior end, in having a dull colored nacre, and in being much more nearly equilateral.

The name *concavus* applied by Lea was, I believe, used by Zelebor for what seems to be *U. tumidus*.

LAMPSILIS VESICULARIS (Lea).

Shell small, subinflated, scarcely subsolid, elliptical or obovate, with a very low posterior ridge; beaks apparently low, but so eroded in the specimens seen that nothing of their character could be made out; surface having irregular growth lines, brownish or dirty yellowish-green, with only the faintest indications of rays, somewhat shining, darker behind; left valve with two low pseudocardinals, the front one rather elongated, the hinder triangular, and two straight laterals; right valve with one pseudocardinal, a vestige of one above it, and another behind it, with one lateral; beak cavities very shallow, with two or three small dorsal pits; muscle scars small, well impressed, the anterior ones separate; nacre whitish-silvery, brilliantly iridescent behind. The female shell has a rounded marsupial swelling.

Length 32, height 19, diam. 12 mm.

Type locality, Lake Okeechobee, Sumpter County, Florida. Also, Flint River, Georgia.

Unio vesicularis LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 156; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 37, pl. XII, fig. 34.; Obs., XIII, 1874, p. 41, pl. XII, fig. 34.—SIMPSON, Pr. U. S. N. Mus., XV, 1892, p. 425, pl. LXVII, fig. 4.

Lampsilis vesicularis SIMPSON, Syn., 1900, p. 562.

Two shells bearing this name are in the Lea collection, one a pair of matched valves, which I think are a variety of *lepidus*, and these are from female shells. The other, the figured type, is smoother, more shining, much more silvery within, is rather elongated, lightly obovate, nearly evenly rounded at both ends and is probably a male shell. It seems nearest to *L. singleyana*. It is very close to forms of *amygdalum* and I have seen

intermediates, which I could not satisfactorily place. The texture of typical forms is different from that of *amygdalum*, being decidedly waxy, and the nacre is rather more silvery.

LAMPSILIS VILLOSA (B. H. Wright).

Shell long obovate, subsolid, somewhat inflated, its greatest diameter just forward of the center, rounded before and behind; posterior ridge almost wanting; beaks low but moderately wide, their sculpture not seen; epidermis dark olive-green to blackish, somewhat shining in the umbonal region, cloth-like around the edges of the shell, rayless or very feebly rayed; left valve with two ragged pseudocardinals, the anterior the higher, sometimes partly connected on their upper edges and having a faint pit between them, with two long, slender laterals; right valve with one pseudocardinal and a vestige of one above it, with one lateral; beak cavities shallow; muscle scars scarcely impressed; nacre bluish-white to lurid, somewhat iridescent and scarcely thinner behind. Female shell with a slight, wide, rounded inflation at the post-base.

Length 42, height 23, diam. 17 mm.

Suwanee and Escambia Rivers, Florida.

Type locality, Suwanee River, Suwanee County, Fla.

Unio villosus B. H. Wright, Naut., XII, 1898, p. 32.

Lampsilis villosus Simpson, Pr. Ac. N. Sci. Phila., 1900, p. 77, pl. 1, fig. 1; Syn., 1900, p. 562.

A species combining the characters of *L. amygdalum* and *minor* to some extent. The pseudocardinals have some resemblance to those of the latter. It is more elongated than either species.

LAMPSILIS TROSSULUS (Lea).

Shell elliptical, subinflated, rather solid, with full, slightly elevated, anterior beaks, which are sculptured with distinctly doubly-looped ridges, the hinder loop angular below; with a moderately developed posterior ridge; surface with low, concentric growth lines, smooth and shining, greenish-yellow with faint rays, being quite green behind and wrinkled on the pos-

terior slope; left valve with two ragged pseudocardinals, the anterior higher and subcompressed, posterior low and feebly developed, with two nearly straight laterals; right valve with one pseudocardinal and a faint one above it, with two laterals, the lower smaller but well developed; beak cavities very shallow, with a few small scars; muscle scars small, somewhat impressed; nacre brilliant, silvery and iridescent, especially behind, and having a rather bluish tint.

Length 35, height 21, diam. 15 mm.

Type locality, Lake Monroe, Florida.

Unio trossulus LEA, Desc. 12 sp. Uniones, 1843; Tr. Am. Phil. Soc., IX, 1846, p. 278, pl. XL, fig. 6; Obs., IV, 1848, p. 36, pl. XL, fig. 6.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 427, pl. LXVIII, fig. 3.

Margaron (Unio) trossulus LEA, Syn., 1852, p. 25; 1870, p. 39.

Lampsilis trossulus SIMPSON, Syn., 1900, p. 562.

I have seen no shell but the type that I can refer with certainty to this species. This specimen is probably a rather young male shell and resembles the bright male specimens of *amygdalum* in some respects. But it is much solider, the hinge is heavier and straighter, and the beaks are more anterior. It seems strange if it is a valid species that the numerous collections made in Lake Monroe should not contain other specimens. There are examples which seem to stand between this and *amygdalum*.

LAMPSILIS PELLUCIDA (Lea).

Shell very thin, obovate, rather compressed to slightly inflated, smooth, inequilateral, the posterior ridge full and rounded; beaks not high, with fine, somewhat doubly-looped ridges; surface smoky brown, with numerous undulating, faint rays; pseudocardinals two in the left valve, the hinder smaller, and one in the right, with a vestige of a second above it, all compressed; two laterals in each valve, the upper in the right valve very faint, all of them delicate and but feebly developed; anterior muscle scars distinct; posterior scars confluent; nacre bluish-white, iridescent. The figure of the type represents a

female shell, which is rounded behind and has a small, marsupial swelling placed well back. The writer found a dead shell at Columbus, Georgia, in the Chattahoochee River, which seems to be a male of this species. It is a little longer in proportion than the figure, and is bluntly pointed behind about midway up from the base.

Length (male) 36, height 21, diam. 13 mm.

Length (female) 33, height 20, diam. 12 mm.

Flint and Chattahoochee Rivers, Georgia.

Type locality, Chattahoochee River, Ga.

Unio pellucidus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 163; Tr. Am. Phil. Soc., X, 1845, p. 70, pl. 11, fig. 6; Obs., IV, 1848, p. 44, pl. 11, fig. 6.

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

Lampsilis pellucidus SIMPSON, Syn., 1900, p. 562.

The type is not in Lea's collection, but belonged to Major Le Conte. It is a remarkably thin shell, of a peculiar, smoky-brown color, rather dark, with numerous darker, wavy, faint rays. In the shell found by the writer the nacre has been somewhat weathered and has turned dark, but in places where it is perfect it is brilliantly iridescent.

LAMPSILIS MINOR (Lea).

Shell small, subsolid to solid, obovate, inflated, its greatest diameter just behind the beaks, from which point to the posterior end it is wedge-shaped; posterior ridge wanting; beaks full, but not high, their sculpture not seen; epidermis black, thick, and cloth-like, rayless; left valve with two rather ragged, solid pseudocardinals, the hinder the larger and higher; they are often united by a ridge on their upper side, and have a pit between them, and two small laterals; right valve with one strong pseudocardinal and one lateral. There is sometimes an extra, small, anterior pseudocardinal in each valve; anterior scars deep; posterior scars well marked; nacre bluish-white, sometimes a little lurid in the center, brilliantly iridescent be-

hind, thicker in front. Both male and female shells are slightly obovate and rounded behind, the female has a considerably produced rounded, marsupial swelling near the posterior end.

Length 30, height 17, diam. 13 mm.

Florida and southwestern Georgia.

Type locality, Lake Monroe and Lake George, Fla.

Unio minor LEA, Desc. 12 sp. Uniones, 1843; Tr. Am. Phil. Soc., IX, 1846, p. 276, pl. XXXIX, fig. 3; Obs., IV, 1848, p. 34, pl. XXXIX, fig. 3.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 425, pl. LXVII, fig. 2.

Margaron (Unio) minor LEA, Syn., 1852, p. 31, 1870, p. 49.

Lampsilis minor SIMPSON, Syn., 1900, p. 562.

Unio stearnsii B. H. WRIGHT, Check List, 1888.

The pseudocardinals of this species are so peculiar that it would almost seem that it should group by itself. The general form, epidermis and nacre would seem to rather closely ally it to varieties of *L. amygdalum*.

LAMPSILIS PAPYRACEA (Gould).

Shell thin, obovate, subcompressed, with a low, posterior ridge, beaks rather low, placed well forward, sculptured with fine, doubly-looped ridges; surface with numerous irregular growth lines, the rest periods well marked, olive-green to rust-brown, the younger shells with numerous indistinct rays, the old shells often rayless; epidermis sometimes a little silky or cloth-like; left valve with a long, low, irregular, compressed pseudocardinal, the front end of it higher, and showing indications of being divided into two or three parts, with two well-developed laterals; right valve with a rather high, compressed pseudocardinal and a vestigial tooth above it, and one lateral; beak cavities shallow; muscle scars faint, the posterior ones scarcely discernible; nacre bluish-white, iridescent throughout, but especially so behind. Male shell full just behind the center of the base, ending behind in a blunt, often feebly biangulate point midway up from the base; female shell nearly evenly rounded behind and having a small, rounded marsupial swelling placed well back.

Length (male) 43, height 26, diam. 15 mm.

Length (female) 35, height 22, diam. 13 mm. Possibly not full grown.

Type locality, Everglades, Florida.

Unio papyraceus GOULD, Pr. Bost. Soc. N. Hist., II, 1845, p. 53.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 427, pl. LXVIII, fig. 2.

Margaron (Unio) papyraceus LEA, Syn., 1852, p. 38; 1870, p. 62.

Lampsilis papyraceus SIMPSON, Syn., 1900, p. 562.

A very fragile species, which appears to be allied to *L. amygdalum*, but is thinner, more compressed and has a different texture.

LAMPSILIS SINGLEYANA (Marsh).

Shell small, subsolid, long elliptical or slightly obovate, not inflated; beaks low, scarcely swollen, their sculpture not seen; surface with delicate, irregular growth lines, shining, a rich tawny or tawny brown, sometimes darker banded; left valve with two low pseudocardinals, the hinder one a mere vestige, and two feeble laterals; right valve with one high, triangular, compressed pseudocardinal and one lateral; beak cavities shallow, with two or three pits; muscle scars well marked; nacre soft, silvery-tinted, flesh-color, and more or less iridescent throughout, especially so behind. I have only seen a few specimens of this pretty little shell, in which the male ends behind in a rounded point at one-half to three-fifths of the distance up from the base. The female shell has a rounded posterior point two-thirds of the way up from the base, and a small, rounded marsupial swelling at the extreme posterior part of the base.

Length 32, height 20, diam. 12 mm.

Putnam and Volusia Counties, Florida.

Type locality, Palatka, Fla.

Unio singleyanus MARSH, Joliet Weekly News (a newspaper), May 1, 1891; Nautilus, V, 1891, p. 29.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 426, pl. LXVIII, figs. 4, 5.

Lampsilis singleyanus SIMPSON, Syn., 1900, p. 563.

A very neat little shell, which seems to be somewhat closely allied to *L. vesicularis*. It is smaller and lighter colored than that species, and the posterior end of the female is somewhat obliquely truncated, while in *vesicularis* it is evenly rounded. There is a small shell in the National museum collection that is probably this, which is considerably rayed.

Subgenus CARUNCULINA Simpson in Baker, 1898.

Caruncula SIMPSON in BAKER, Moll. Chicago, Pt. I, 1892, p. 109; Syn., 1900, p. 563. — ORTMANN, Ann. Car. Mus., VIII, 1912, p. 337.

Shell small, inflated, obovate, rather solid, covered with a thick, dark, often cloth-like epidermis, which is rayless or only feebly rayed; beak sculpture consisting of rather strong, concentric ridges, which form, as a general thing, only a single, rounded loop in front, and are strongly curved upward behind. Pseudocardinals compressed, smooth on the inside, generally reflexed upward, somewhat torn on the edges. Shell quite commonly pointed posteriorly, that of the female truncated obliquely on post-base. Animal with marsupium consisting of a few large ovisacs (8 to 13); inner gill wholly or in part free from the abdominal sac; female often having a well-developed caruncle on the mantle below the branchial opening.

Type, *Unio texasensis* Lea.

Ortmann, (l. c.), considers this group a subgenus of *Eurynia*.

LAMPSILIS TEXASENSIS (Lea).

Shell somewhat elliptical, subcompressed to inflated, beaks low, but full in inflated specimens, sculptured with from seven to nine sharp ridges, which fall in a single loop and are curved upward rather suddenly behind to the posterior ridge, from which they return towards the nucleus in nearly convergent raised lines; posterior ridge well marked; surface covered with a thick, brownish or blackish epidermis, which is often chestnut tinted in the umbonal region; left valve with two compressed, ragged pseudocardinals, which are slightly reflexed,

and two curved laterals; right valve with one pseudocardinal and a vestige of another above it, with one lateral; beak cavities shallow, with a few rather large scars; anterior cicatrices separate; posterior cicatrices well impressed; nacre bluish-white to salmon, generally silvery iridescent and slightly thinner behind. The male shell is full and sometimes a little angular on the basal line just behind the center, and ends in a rounded or slightly biangulate point behind, midway up from the base. The female shell has a strongly developed, rather angular marsupial swelling at some distance from the posterior end; from the swelling to the elevated posterior point it is truncated. It is smaller than the male shell.

Length (male) 50, height 30, diam. 20 mm.

Length (female) 40, height 28, diam. 20 mm.

Texas, north to Kansas; Missouri; southern Illinois and Indiana; south through Tennessee, Alabama, Mississippi, and Louisiana.

Type locality, DeWitt Co., Tex.

Unio parvus CONRAD, Monog. II, 1836, p. 20, pl. IX, fig. 1.—HANLEY, Biv. Shells, 1843, p. 196, pl. XXII, fig. 3.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXV, fig. 186.

Unio texasiensis LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 84.

Unio texasensis LEA, Jl. Ac. N. Sci. Phila., IV, 1860, p. 359, pl. LXI, fig. 184; Obs., XVIII, 1860, p. 41, pl. LXI, fig. 184.—CALL, Pr. Ind. Acad. Sc., 1896, p. 3, pl. V, figs. 38-40.

Margaron (Unio) texasensis LEA, Syn., 1870, p. 49.

Lampsilis texasensis SIMPSON, Syn., 1900, p. 563.

Eurynia (Carunculina) texasensis ORTMANN, Ann. Car. Mus., VIII, 1912, p. 339.

Unio texasianus SOWERBY, Conch. Icon., XVI, 1866, pl. XL, fig. 218.

Unio bairdianus LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 102; Jl. Ac. N. Sci. Phila., IV, 1860, p. 361, pl. LXI, fig. 186; Obs., VIII, 1860, p. 43, pl. LXI, fig. 186.

Margaron (Unio) bairdianus LEA, Syn., 1870, p. 49.

Unio bealei LEA, Pr. Ac. N. Sci. Phila., VI, 1862, p. 169; Jl. Ac. N. Sci. Phila., V, 1862, p. 204, pl. XXX, fig. 273; Obs., IX, 1863, p. 26, pl. XXX, fig. 273.

Margaron (Unio) bealei LEA, Syn., 1870, p. 49.

The species was described from a young, delicate male shell. Afterwards Lea described a young female as *Unio bairdianus* and still later *Unio bealei* from a larger, somewhat compressed male shell.

Var. *compressa* Simpson.

Shell subcompressed to compressed, rather thin, high and short, of an almost regular elliptical outline.

Type locality, southwestern Texas.

Lampsilis texasensis var. *compressus* SIMPSON, Syn., 1900, p. 564.

All the specimens I have seen of the variety seem to be a little diseased, yet the form differs so widely from the type that I cannot believe it to be the result of pathologic influences.

LAMPSILIS MEARNSI Simpson.

Shell short or long elliptical, considerably inflated, quite solid, with a well-developed, narrowly rounded post-basal ridge, with full elevated beaks, whose sculpture consists of a few singly looped, wavy ridges well drawn up behind; surface with irregular growth lines, greenish-yellow often with one or more dark green bands, usually the lower part of the posterior end of the shell is dark green, the patch ending quite abruptly in front. Sometimes there is one very broad green ray just behind the center and occasionally this is split into finer rays; epidermis rather silky; left valve with two compressed, slightly recurved pseudocardinals, and two long laterals, which extend to the pseudocardinals; right valve with one pseudocardinal, a faint one above it, and one lateral; beak cavities shallow; muscle scars well impressed; nacre white, flesh-color or pale salmon, rich and silvery iridescent, thinner behind. The male shell is much larger and longer than that of the female; it has a slight, somewhat angular projection at the post-base, the posterior point is sharp and elevated midway up from the base,

and it is truncate on the lower hinder part. The female shell has a large, wide, rounded marsupial swelling behind the central base, and a sharp posterior point elevated two-thirds of the distance from the base.

Length (male) 55, height 33, diam. 23 mm.

Length (female) 40, height 27, diam. 21 mm.

Type locality, vicinity of Fort Clarke, Kinney County, Tex.

Lampsilis mearnsi SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 75, pl. 1, fig. 4; Syn., 1900, p. 564.

An attractive and remarkable species, which is allied to *L. texasensis,* but differs in being more robust, more inflated, in having fewer and different ridges on the beaks, and in the color pattern. *L. texasensis* is unicolored and dark; in *mearnsi* there is almost always a very wide, broken ray or squarish blotch and one or more dark, concentric bands on a yellowish ground.

LAMPSILIS PARVA (Barnes).

Shell long elliptical or subcylindrical, generally a very little wider behind, inflated, subsolid, with full, but not high, beaks, which are turned forward over a narrow lunule, their sculpture consisting of seven or eight single-looped ridges, which are curved up more behind than in front, and return at the posterior end in converging lines to the nucleus; posterior ridge wanting; epidermis thick and cloth-like, blackish or fuscous, often brownish in the umbonal region; left valve with two compressed, ragged, recurved pseudocardinals, and two delicate laterals; right valve with one pseudocardinal, a minute one above it, and a single lateral; beak cavities and muscle scars shallow, nacre bluish-white, silvery and somewhat iridescent behind, slightly thickened in front. The male and female shells are much alike, the latter being more inflated and a little fuller at the extreme post-basal region. The male shell is usually evenly rounded behind, that of the female is often a little truncate and sometimes has a blunt point above. The greatest diameter is behind the center of the shell, and the female is remarkable for sometimes having the diameter greater than the height.

Length 32, height 17, diam. (of male) 13 and (of female) 21 mm.

Mississippi River drainage generally; southwest to central Texas; western New York; southern Canada; and Michigan.

Type locality, Fox River.

Unio parvus BARNES, Am. Jl. Sci., VI, 1823, pl. XIII, fig. 18 (outline).—PHILIPPI, Abbild., I, 1845, p. 19, pl. 1, fig. 4.—KUSTER, Conch. Cab. Unio, 1852, p. 33, pl. V, fig. 5.

Margarita (Unio) parvus LEA, Syn., 1836, p. 28; 1838, p. 21.

Margaron (Unio) parvus LEA, Syn., 1852, p. 31; 1870, p. 49.

Lampsilis parvus BAKER, Moll. Chi., Pt. I, 1898, p. 109, pl. XIII, fig. 3.—SIMPSON, Syn., 1900, p. 564.

Mya parva EATON, Zool. Text-Book, 1826, p. 222.

Eurynia (Carunculina) parva ORTMANN, Ann. Car. Mus., VIII, 1912, p. 338.

This species has often been confounded with *L. texasensis*, to which it is not very closely allied. Even Dr. Lea placed several specimens of the latter with his *parva*. It differs from all other members of the group in having the female shell greatly inflated, and in having the shells of both sexes almost evenly rounded behind. Generally it is one of the smallest of the Uniones, but it sometimes attains a length of two inches.

LAMPSILIS HALEIANA (Lea).

Shell long elliptical or obovate, subinflated, scarcely subsolid; beaks somewhat full and raised above the dorsal outline, sculptured with seven or eight strong, singly looped ridges, which are wel curved up behind; sometimes the beak sculpture is slightly doubly looped; surface with numerous low, irregular, concentric ridges, rayless or nearly so, and covered with an olive-green or brown epidermis; left valve with two compressed. slightly recurved pseudocardinals, and two curved laterals; right valve with one compressed pseudocardinal and one lateral; beak cavities and adductor scars shallow; nacre silvery, bluish-white, iridescent, and a little thinner behind. Male shell a little full and subangular in the post-basal region with a rounded point behind midway up from the base; female shell shorter, somewhat obovate, with a full, rounded marsupial

swelling, just behind the middle of the base, and the posterior end blunt, rounded, and a little elevated.

Length (male) 70, height 40, diam. 25 mm.

Length (female) 57, height 33, diam. 22 mm.

Alexandria, Louisiana; eastern Texas.

Type locality, Mississippi River, thirty miles above New Orleans, La.

Unio haleianus LEA, Pr. Am. Phil. Soc., II, 1842, p. 224; Tr. Am. Phil. Soc., VIII, 1842, p. 247, pl. XXVII, fig. 63; Obs., III, 1842, p. 85, pl. XXVII, fig. 63.—CHENU, Ill. Conch., 1858, pl. XXVI, figs. 6, 6*a*, 6*b*.—? REEVE, Conch. Icon., XVI, 1865, pl. XXIV, fig. 116.

Margaron (Unio) haleianus LEA, Syn., 1852, p. 31; 1870, p. 49.

Lampsilis haleianus SIMPSON, Syn., 1900, p. 564.

This species is close to *L. texasensis*, but is larger and thinner, and the epidermis is usually lighter colored. The female shell is more rounded behind than it is in *texasensis*. Specimens have been found in Old River, Victoria County, Texas, which agree very well with *haleiana* in size, form and solidity, but which have a darker epidermis and a pale, dirty salmon nacre. I cannot be certain which species they should be referred to. The *L. haleiana* sometimes has doubly-looped beak sculpture.

LAMPSILIS GLANS (Lea).

Shell short elliptical, rather solid, inflated, with a low, rounded posterior ridge, and a decided lunule, with full, high beaks, having irregular, subnodulous ridges, which curve up somewhat behind, and are nodulous at the posterior ridge, returning by converging lines to the embryonic shell; surface with irregular, growth lines, rayless, covered with a dark brownish, thick epidermis; left valve with two irregular, ragged pseudocardinals, which are often united by a ridge at their upper sides, and two laterals; right valve with one pseudocardinal and sometimes a vestige of another above it, and two laterals, or with one and a faint second one below it; beak cavities shallow; muscle scars well impressed; nacre generally purple and lighter on the border, though sometimes creamy white, suddenly becoming thin-

ner behind, where it is usually iridescent. The male shell is short elliptical or subrhomboid, the blunt, rounded posterior point being at or below the middle of the height of the shell. The female shell is shorter and a little more inflated; it has a decided angular marsupial swelling at the posterior base, and the posterior point is elevated two-thirds of the way up from the base of the shell.

Length (male) 36, height 24, diam. 17 mm.

Length (female) 32, height 24, diam. 18 mm.

Ohio River drainage; Warsaw, Indiana; (probably St. Lawrence drainage); southern Michigan; White River, Carroll County, Arkansas (Call); Etowah River, Georgia.

Type locality, Ohio River.

Unio glans LEA, Tr. Am. Phil. Soc., 1834, p. 82, pl. XVIII, fig. 12; Obs., I, 1834, p. 92, pl. VIII, fig. 12.—CONRAD, Monog., II, 1836, p. 21, pl. IX, fig. 2.—HANLEY, Biv. Shells, 1843, p. 196, pl. XXII, fig. 33.—KUSTER, Conch. Cab. Unio, 1852, p. 37, pl. VI, fig. 3.—CHENU, Ill. Conch., 1858, pl. VIII, figs. 9, 9*a*, 9*b*. —SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVI, fig. 190.

Margarita (Unio) glans LEA, Syn., 1836, p. 28; 1838, p. 21.

Margaron (Unio) glans LEA, Syn., 1852, p. 31; 1870, p. 49.

Lampsilis glans SIMPSON, Syn., 1900, p. 565.

Eurynia (Carunculina) glans ORTMANN, Ann. Car. Mus., VIII, 1912, p. 339.

This species is usually quite distinct from all others. It is shorter, solider and more inflated than *germana* and differs in having a purple nacre; it is very much shorter than *cylindrella* and the female is shaped differently from either of the above species. Occasional shells have a whitish nacre.

LAMPSILIS GERMANA (Lea).

Shell long elliptical or a little rhomboid, that of the female slightly obovate, subsolid, subcompressed to subinflated, with a rounded posterior ridge and small, somewhat compressed, but rather elevated beaks, their sculpture not seen; surface finely concentrically sculptured, rayless, covered with a black or brown, thick epidermis; left valve with two rather ragged, com-

pressed pseudocardinals and two straight laterals; right valve with one pseudocardinal and sometimes a feeble tooth above it, with one lateral; beak cavities shallow but compressed; muscle scars shallow; nacre bluish or purplish-white, richly iridescent behind, scarcely thicker in front. The male and female shells differ but little, the former is sometimes a little rhomboid, the rounded posterior point being nearest the base; the female shell has a feeble, but long, marsupial swelling, and the posterior point is about midway up.

Length 38, height 22, diam. 15 mm.

Type locality, Coosa River. Also Big Prairie Creek, Alabama.

Unio germanus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 40; Jl. Ac. N. Sci. Phila., VI, 1866, p. 49, pl. XIX, fig. 54; Obs., XI, 1867, p. 53, pl. XIX, fig. 54.

Margaron (Unio) germanus LEA, Syn., 1870, p. 49.

Lampsilis germanus SIMPSON, Syn., 1900, p. 565.

Unio granulatis LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 60.

Unio granulatus LEA, Jl. Ac. N. Sci. Phila., VI, 1866, p. 48, pl. XVI, fig. 46; Obs., XI, 1867, p. 52, pl. XVI, fig. 46.

Margaron (Unio) granulatus LEA, Syn., 1870, p. 49.

This species has no strong characters, but it is less solid and inflated than *L. corrunculus* and *L. cylindrella*, and it differs from the latter in the color of the nacre. It is darker colored and much more sulcate than *L. cromwellii*.

LAMPSILIS CYLINDRELLA (Lea).

Shell long elliptical, with the dorsal and ventral lines nearly parallel, solid, subinflated, with rather full, but not high, beaks, their sculpture not seen; posterior ridge low or wanting; surface tawny, rayless, with a thick epidermis; left valve with two stumpy pseudocardinals and two laterals; right valve with one pseudocardinal, and one lateral, which sometimes has a slight ridge at its inner base; beak cavities shallow, with one or two pits; muscle scars well impressed; nacre whitish at the border, rich coppery within, thinner and iridescent behind. The female

shell differs but very little from that of the male, having a faint marsupial swelling near the posterior part of the base and both are nearly evenly round behind.

Length 37, height 20, diam. 16 mm.

Tennessee River drainage.

Type locality, Duck River, Tenn.; Swamp Creek, Whitfield Co., Ga.; northern Alabama.

Unio cylindrellus LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 144; Jl. Ac. N. Sci. Phila., VIII, 1869, p. 308, pl. XLVIII, fig. 121; —Obs., XII, 1869, p. 68, pl. XLVIII, fig. 121.

Margaron (Unio) cylindrellus LEA, Syn., 1870, p. 49.

Lampsilis cylindrellus SIMPSON, Syn., 1900, p. 565.

The solid, long, almost cylindrical shell and the coppery nacre, bordered with lighter color, distinguish this from allied species. The specimens I take to be females differ but very little from the males, being only a very little fuller in the post-basal region.

LAMPSILIS MŒSTA (Lea).

Shell long elliptical or subrhomboid, subinflated, rather solid, with a very faint posterior ridge; beaks probably full; surface concentrically striate, having an olive-brown epidermis, rayless; left valve with two stumpy pseudocardinals and two short laterals; right valve with one pseudocardinal and one lateral; beak cavities not deep, having a few deep pits; nacre dirty, dark purple, somewhat thinner and iridescent behind.

Length 47, height 26, diam. 18 mm.

Type locality, French Broad River, Tennessee.

Unio mœstus LEA, Pr. Am. Phil. Soc., II, 1841, p. 82; Tr. Am. Phil. Soc., VIII, 1842, p. 244, pl. XXVI, fig. 60; Obs., III, 1842, p. 82, pl. XXVI, fig. 60.—CHENU, Ill. Conch., 1858, pl. XXVIII, figs. 3, 3*a*, 3*b*.—KUSTER, Conch. Cab. Unio, 1861, p. 226, pl. LXXVI, fig. 5.

Margaron (Unio) mœstus LEA, Syn., 1852, p. 31; 1870, p. 49.

Lampsilis mœstus SIMPSON, Syn., 1900, p. 565.

Only two specimens, both in the Lea collection, and one of them the type, have been seen by the writer. Both are dead and badly eroded. One is somewhat rhomboid, the upper posterior part being slightly truncated; the post-basal point is widely rounded. The other is nearly evenly rounded behind and may be a female, though it has no perceptible post-basal swelling. I cannot be certain as to the systematic position of this species. Its texture and color are much like those of *L. vanuxemensis,* but the form is most like that of members of the *parva* group. It is larger and much darker colored than *L. cylindrella,* it is larger and solider than *germana,* and has a darker nacre.

LAMPSILIS CROMWELLII (Lea).

Shell somewhat obovate, subsolid, subcompressed or but slightly inflated, with a low, rounded posterior ridge; beaks rather high and sharp, sculptured beautifully with eight or more regularly curved ridges, their curve being shorter than that of the growth lines; surface with fine growth lines, greenish-yellow, sometimes clouded with green, often having two light colored rays on the posterior slope, and concentrically banded with lighter color; epidermis only moderately thick; left valve with two compressed, ragged peudocardinals and two curved laterals; right valve with one irregular pseudocardinal and sometimes a double lateral; beak cavities shallow; posterior muscle scars faint; nacre white or lurid, silvery, iridescent and a little thinner behind. Male shell a little rhomboid or evenly rounded behind; female shell with a feeble, subangular marsupial swelling, the shell behind it is truncate up to the somewhat elevated posterior point.

Length 27, height 17, diam. 12 mm.

Western Georgia and southeastern Alabama.

Type locality, Kiokee Creek, Albany, Dougherty Co., Ga.

Unio cromwellii LEA, Pr. Ac. N. Sci. Phila., IX, 1865, p. 89; Jl. Ac. N. Sci. Phila., VI, 1869, p. 258, pl. XXXI, fig. 73; Obs., XII, 1869, p. 18, pl. XXXI, fig. 73.

Margaron (Unio) cromwellii LEA, Syn., 1870, p. 49.

Lampsilis cromwellii SIMPSON, Syn., 1900, p. 565.

Unio marginis LEA, Pr. Ac. N. Sci. Phila., IX, 1865, p. 89; Jl. Ac. N. Sci. Phila., VI, 1869, p. 225, pl. XXXI, fig. 69; Obs., XII, 1869, p. 15, pl. XXXI, fig. 69.

Margaron (Unio) marginis LEA, Syn., 1870, p. 49.

A smoother, lighter colored shell than that of *corvunculus*, and the nacre is not purple. The beak sculpture consists of semicircular ridges, while those of *corvunculus* follow the growth lines. This and *Unio marginis* seem to me to be absolutely identical.

LAMPSILIS CORVUNCULUS (Lea).

Shell elliptical or obovate, subcompressed or scarcely inflated, rather thin to subsolid, with low beaks, which are sculptured with a few singly-looped ridges, which nearly follow the growth lines; posterior ridge wanting; surface with irregular growth lines, and covered with a thick, brownish or blackish epidermis; left valve with two somewhat compressed ragged pseudocardinals which are partly joined above, and two low, curved laterals; right valve with one pseudocardinal and a vestige of a second above it, with one lateral having a groove along its lower face; beak cavities shallow; posterior scars faint; nacre purple, iridescent and slightly thinner behind. The male shell is somewhat rhomboid, but nearly evenly rounded behind; that of the female has a small, angular marsupial swelling not far from the posterior end, and is obliquely truncated below the elevated posterior point.

Length 32, height 20, diam. 12 mm.

Western Georgia; Village Creek, Jefferson County, Alabama; Lake Ashby, Florida.

Type locality, Swamp Creek, Whitfield County, Georgia.

Unio corvunculus LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 144; Jl. Ac. N. Sci. Phila., VI, 1869, p. 314, pl. L, fig. 127; Obs., XII, 1869, p 74, pl. L, fig. 127.

Margaron (Unio) corvunculus LEA, Syn., 1870, p. 49.
Lampsilis corvunculus SIMPSON, Syn., 1900, p. 566.

Thinner, shorter and more compressed than *L. paula*, and it has a purple instead of a whitish nacre. The female does not have the small radial ridge that is found on that of *paula*.

LAMPSILIS PAULA (Lea).

Shell long elliptical, rather solid, inflated; beaks full but not high, sculptured, with a few singly-looped ridges, which are curved up quite sharply behind; surface covered with irregular growth lines, which sometimes form strong concentric ridges; in the young shells the epidermis is often green with one or two light rays on the posterior slope and with concentric yellowish bands; in the adult shells it is thick and black; left valve with two low, irregular, ragged pseudocardinals, which are often partly joined together and are sometimes slightly reflexed, and two laterals; right valve with one pseudocardinal, sometimes with a vestige of a second, and one lateral; beak cavities shallow; muscle scars well marked; nacre dirty white or lurid, iridescent behind. Male shell nearly evenly long elliptical, rounded before and behind, slightly thicker in front; female shell irregularly long elliptical; the posterior base but slightly swollen, angular, and there is often a small radiating ridge leading from the beaks to this part of the shell; behind this it is obliquely truncate to the posterior point, which is more than midway up from the base; the hinder part of the shell is much thinner than the front part.

Length (male) 37, height 22, diam. 16 mm.

Length (female) 36, height 21, diam. 20 mm.

Flint and Chattahoochee Rivers, Georgia.

Type locality, Chattahoochee River, Columbus, Ga.

Unio paulus LEA, Pr. Am. Phil. Soc., I, 1840, p. 287; Tr. Am. Phil. Soc., VIII, 1842, p. 213, pl. XV, fig. 29; Obs., III, 1842, p. 51, pl. XV, fig. 29.—CHENU, Ill. Conch., 1858, pl. XXVII, figs. 5, 5*a*, 5*b*.—KUSTER, Conch. Cab. Unio, 1861, p. 260, pl. LXXXVII, fig. 6.

Margaron (Unio) paulus LEA, Syn., 1852, p. 31; 1870, p. 49.

Lampsilis paulus SIMPSON, Syn., 1900, p. 566.

Eurynia (Carunculina) paula ORTMANN, Ann. Car. Mus., VIII, 1912, p. 339.

Unio corvinus LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 144; Jl. Ac. N. Sci. Phila., VI, 1869, p. 310, pl. XLVIII, fig. 123; Obs., XII, 1869, p. 70, pl. XLVIII, fig. 123.

Margaron (Unio) corvinus LEA, Syn., 1870, p. 49.

The type of Lea's *paulus* is a male shell and that of his *corvinus* is a female of the same species. The post-basal swelling of the female scarcely projects below the base line of the shell, but it is angular and this with the peculiar radial ridge leading over it as well as the sudden thickening of the front part of the shell are good distinguishing characters. The male shell is much like that of *L. germana*, but is solider, more inflated and darker.

LAMPSILIS PULLA (Conrad).

Shell long elliptical or subrhomboidal, subinflated, especially at the center, rather solid; dorsal and ventral lines almost parallel; beaks moderately full, but not high, eroded in the specimen figured; epidermis dark olivaceous; left valve with two pseudocardinals and two laterals; right valve with one pseudocardinal and one lateral; nacre chocolate-purple, iridescent behind; beak cavities capacious.

Length 33, height 17, diam. 12 mm.

Type locality, Wateree River, South Carolina. Also, Warm Springs, North Carolina.

Unio pullus CONRAD, Monog., XI, 1838, p. 100, pl. LIV, fig. 2.—KUSTER, Conch. Cab. Unio, 1862, p. 270, pl. XCI, fig. 2.

Margaron (Unio) pullus LEA, Syn., 1852, p. 31; 1870, p. 49.

Lampsilis pullus SIMPSON, Syn., 1900, p. 566.

In form this is a good deal like *L. mœsta*, being obliquely truncated on the posterior slope and rounded at the posterior basal-point. It is a smaller species, and, according to Conrad, it must have a much darker nacre, which is iridescent behind, while that of *mœsta* does not seem to be. It differs from *cylindrella* in being much darker, and in having uniformly purple

nacre, while that of the last named species is bordered with white. The shell figured by Conrad is probably a male. According to Conrad its greatest diameter is at the middle of the shell, and from that point it rapidly tapers toward each end.

Conrad's figure is a poor one, and I can not be positive just where the species should be placed, but incline to think it a member of the *texasensis* group. Lea has a shell, which he calls the *Unio pullus* of Conrad, which came from Ravenel, labeled "S. Carolina," but which, I think, is not this, but some species of the *subrostrata* group. It is quite probable that *pulla* is the same as Lea's *corruncula*.

Subgenus Proptera Rafinesque, 1819.

Proptera Rafinesque, Jl. Phys. Chim. Hist. Nat., LXXXVIII, 1819, p. 426.—Simpson, Syn., 1900, p. 566.—Ortmann, Ann. Car. Mus., VIII, 1912, p. 339.

Metaptera Rafinesque, Ann. Gen. Sci. Phys. Brux., V, 1820, p. 299.

Shell usually large, gaping at the anterior base and edge of the dorsal slope, winged along the dorsal region when young and often when adult; beak sculpture feeble, consisting, when developed, of an anterior and posterior loop, the former often wanting; the latter sometimes becomes slightly nodulous; epidermis generally brown, often cloth-like when fresh, rayless or feebly rayed; teeth rather compressed, pseudocardinals frequently imperfect or nearly wanting; laterals remote; anterior muscle scars often complicated; dorsal scars consisting of a row of from four to thirty distinct, often deep, impressions, running from the cavity of the beak obliquely downward anteriorly; nacre purplish. Animal with large branchiæ; marsupium consisting of numerous, generally fine, ovisacs, which are often somewhat radial; mantle thickened and distinctly double on the border, often papillose behind, where the outer fold develops into a thickened flap; branchial opening with irregular teeth; anal opening smooth or only slightly crenulate

Type, *Unio alata* Say.

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

Group of *Lampsilis alata.*

Shell obovate, strongly winged, subsolid, with a slight posterior and superposterior ridge; epidermis thick, dark, showing irregular growth lines; hinge teeth generally well developed; nacre dark purple; female shell greatly developed in post-basal region. Animal having the ovisacs very numerous and fine; marsupium large; inner gills united to abdominal sac throughout.

LAMPSILIS ALATA (Say).

Shell large, inequilateral, somewhat obovate, rather compressed, subsolid, narrowed in front where it is rounded in adult shells, but in the young shell it has a small angular dorsal wing; beaks low, compressed, their sculpture very faint, consisting of feeble, broken ridges or sometimes of nodules, which show a slight tendency in the direction of double looping; there is a low but rather pinched up ridge running from the beaks down the posterior slope of the shell to its edge, and above this it is carried up into a high triangular dorsal wing, which is beautifully developed in young shells, but usually is broken away in old ones; below the upper posterior ridge there is often a second ridge, which reaches to the extreme posterior part of the shell; posterior end of the shell wide and rounded; surface with irregular, concentric sculpture, brownish, blackish or olive-green, sometimes faintly rayed in young specimens; in adult shells the unbonal region is reddish-brown. Left valve with ragged, generally compressed pseudocardinals, with sometimes a vestige of a third above the anterior one, and two remote, curved laterals; right valve with two pseudocardinals, the lower the larger and one high, truncated lateral; muscle scars large, the anterior appressed, posterior scars faint; beak cavities shallow; dorsal scars numerous, in a row running downward; ligament and escutcheon large; nacre coppery-purple, somewhat thickened in front. The female shell has a large, rounded marsupial swelling at the extreme post-basal part and is generally sub-

truncate behind; the male shell is less full in the post-basal region, and is nearly rounded behind.

Length 160, height to point of broken wing 120, diam. 40 mm.

Entire Mississippi drainage as far south as Arkansas; St. Lawrence drainage; Red River of the North.

Type locality not given.

Unio alatus SAY, Nich. Encyc., II, 1817, pl. IV, fig. 2.—HILDRETH, Am. Jl. Sci., XIV, 1828, p. 285, fig. 17.—CONRAD, Monog., VII, 1836, p. 57, pl. XXXI.—SOWERBY, Conch. Man., 1839, fig. 147.—REEVE, Conch. Syst., I, 1841, p. 118, pl. LXXXIX, fig. 8.—C. B. ADAMS, Thompson's Hist. of Vermont, 1842, p. 166, fig; L. and F. W. Shells of Vermont, 1842, p. 16, fig.—POTIEZ and MICHAUD, Gall. Moll., 1844, p. 146, pl. LVI, fig. 2.—KUSTER, Conch. Cab., 1852, p. 15, pl. 1, fig. 1.—CHENU, Man., 1859, II, p. 143, fig. 708.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLIV, fig. 242.

Margarita (Unio) alatus LEA, Syn., 1836, p. 11; 1838, p. 13.

Margaron (Unio) alatus LEA, Syn., 1852, p. 19; 1870, p. 28.

Lampsilis alatus BAKER, Moll. Chicago, Pt. 1, 1898, p. 97, pl. XVIII.—SIMPSON, Syn., 1900, p. 567.

Unio alata LAMARCK, An. sans Vert., VI, 1819, p. 76.

Mya alata, EATON, Zool. Text-Book, 1826, p. 219.—WOOD, Index Test. (Rev.), 1856, p. 199, pl. 1, supp. fig. 3.

Symphynota alata LEA, Tr. Am. Phil. Soc. III, 1830, p. 448; Obs., I, 1834, p. 62.

Lymnadia alata SWAINSON, Treat. on Mal., 1840, p. 265, fig. 48.

Mysca alata SWAINSON, Exotic Conch., 2d ed., 1841, p. 28, pl. VII.

Metaptera alata STIMPSON, Shells of N. Eng., 1851, p. 14.

Proptera alata ORTMANN, Ann. Car. Mus., VIII, 1912, p. 333.

? Metaptera metaptera RAFINESQUE, Ann. Gen. Sci., Brux, V, 1820, p. 300, pl. LXXX, figs. 20-22.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 15, pl. 1, figs. 20-22.

Var. *poulsoni* (Conrad).

More solid and inflated than typical shells and narrower in front. The two posterior ridges are quite distinctly developed, the outlne from the hinder end of the post-dorsal wing to the end of the upper ridge is incurved, and that between the two ridges is often incurved. Its surface is rougher than in the type, and the teeth are rather heavier. This may almost be considered a distinct species, but it is connected with typical forms by an abundance of material in the Tennessee region.

Length 123, height 80, diam. 43 mm.

Alabama and Tombigbee Systems.

Type locality, Black Warrior River, Ala.

Unio poulsoni CONRAD, New F. W. Shells, 1834, p. 25, pl. 1; p. 71.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 15, pl. 1, fig. 7.

Symphynota poulsoni FERUSSAC, Guer. Mag., 1835, p. 25.

Lampsilis alatus var. *poulsoni* SIMPSON, Syn., 1900, p. 568.

This species is solider, darker colored and has darker nacre than *L. gracilis* and *lævissima*, with which it is most often associated. The female shell is more produced in the post-basal region than in either of those species. It is less inflated and ponderous than *L. purpurata*.

LAMPSILIS COLORADOENSIS (Lea).

Shell large, irregularly obovate, subsolid, with a rather distinct posterior ridge and two slightly elevated, dark, radial ridges on the posterior slope; beaks somewhat full and high, their sculpture consisting of corrugated, doubly-looped ridges; posterior wing broken off down to the large ligament in half grown to adult shells; surface with irregular growth lines, pale smoky-brown, nebulously banded and rayed with olive; left valve with two ragged, elevated, subcompressed pseudocardinals, the anterior the larger, and two short, remote laterals; right valve with two pseudocardinals, the upper smaller, and one high, truncated lateral; beak cavities moderately deep, with an irregular row of pits running towards the anterior base; anterior scars deep, separate; posterior scars large and shal-

low; nacre purplish, thicker in front. The male shell is somewhat truncated at the post-dorsal part and is full in the post-basal region, ending in a blunt point just below the medium line. The female shell, of which I have only seen young specimens, is fuller in the post-basal region than that of the male, and is nearly rounded behind.

Length 123, height 76, diam. 40 mm.

Eastern Texas.

Type locality, Rio Colorado, Texas.

Unio coloradoensis LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 103; Jl. Ac. N. Sci. Phila., III, 1858, p. 314, pl. XXXI, fig. 29; Obs., VI, 1857, p. 34, pl. XXXI, fig. 29.

Margaron (Unio) coloradoensis LEA, Syn., 1870, p. 41.

Lampsilis coloradoensis SIMPSON, Syn., 1900, p. 568.

Probably only a mere variety of *purpurata*. It is less inflated, lighter colored, and is less solid than that species. I have only seen three or four authentic specimens and hardly feel like making it a variety of *purpurata* without more evidence.

LAMPSILIS ROVIROSAI Pilsbry.

Shell large, moderately solid, obovate, inflated, with strongly marked, somewhat sulcate growth lines; epidermis dark brown or blackish, with very fine concentric wrinkles; beaks moderately elevated, full; ligament large; posterior ridge rounded and above it on the posterior slope there is a radial depression; hinge line slightly curved; left valve with two small, slightly ragged, subtriangular pseudocardinals and two short, heavy, remote laterals; right valve with two pseudocardinals, the upper rudimentary, and a high, striated lateral; anterior scars deep and smooth, the adductors large; posterior scars large, nearly semicircular; nacre soft flesh-color in the cavity of the shell, whitish at the border, iridescent behind; beak cavities moderately deep, with a row of muscle scars running towards the anterior base. Hinge line narrow between the two sets of teeth, and occupied with epidermal matter.

Length 112, height 72, diam. 45 mm.

Laguna de Atasta, near San Juan Bautista, Mexico.

Unio (Lampsilis) rovirosai PILSBRY, Nautilus, XIII, 1900, p. 140.

Lampsilis rovirosai SIMPSON, Syn., 1900, p. 568.—PILSBRY, Pr. Ac. N. Sci. Phila., 1903, p. 788, pl. LIV, figs. 1, 1*a*.

Only the type in the Philadelphia Academy of Sciences is known, and this is somewhat narrowed in front, with a long and rather full, rounded post-basal swelling, which does not reach to the posterior end. The posterior point is blunt and rounded, two-thirds of the way up from the base. It is nearest to *L. purpurata* but is more decidedly sulcate, the nacre is much lighter colored, and the beaks are lower. The beaks of the specimen seen are so badly eroded that the sculpture is destroyed. This is probably a female, and the post-basal swelling is larger and farther from the posterior end than it is in *purpurata*.

LAMPSILIS PURPURATA (Lamarck).

Shell very large, somewhat obovate, inflated, with full, high beaks, having very faint, corrugated sculpture, scarcely winged in front, with a low, angular wing behind; there are two or sometimes three low, radiating ridges on the posterior slope; surface nearly smooth or somewhat sulcate, covered with a shining, blackish epidermis; ligament large and long, generally exposed in adult shells; left valve with two subcompressed to solid, ragged pseudocardinals and two strong, remote laterals, the hinge line rounded between the two sets of teeth; right valve with two pseudocardinals, the lower the larger, and one strong, truncated lateral; beak cavities rather deep, with a row of deep scars running towards the anterior base; muscle scars large, the anterior deep and smooth, the posterior scarcely impressed; nacre rich, dark purple, somewhat iridescent behind, much thicker in front. Male shell full at the posterior base, rounded and obtusely biangulate behind above the median line; the female shell has a wide, rounded, marsupial swelling far behind, and is decidedly truncate posteriorly.

Length 170, height 110, diam. 67 mm.

Length (female) 130, height 90, diam. 58 mm.

Eastern Texas, north to Kansas, through southern Missouri, western Tennessee, to the Alabama River drainage.

Type locality, "Africa"!!

Unio purpurata LAMARCK, An. sans Vert., VI, 1819, p. 71.

Unio purpuratus LEA, Obs. I, 1834, p. 199.—HANLEY, Biv. Shells, 1843, p. 208, pl. XXII, fig. 5.—KUSTER, Conch. Cab. Unio, 1861, p. 185, pl. LIX, fig. 1.—REEVE, Conch. Icon., XVI, 1865, pl. XXIV, fig. 115.—CALL, Tr. Ac. Sci. St. Louis, VII, No. 1, 1895, p. 38, pl. V.

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

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

Lampsilis purpuratus SIMPSON, Syn., 1900, p. 568.

Proptera purpurata ORTMANN, Ann. Car. Mus., VIII, 1912, p. 334.

Unio ater LEA, Tr. Am. Phil. Soc., III, 1830, p. 426, pl. VII, fig. 9; Obs. 1, 1834, p. 40, pl. VII, fig. 9.—CHENU, Ill. Conch., 1858, pl. X, figs. 1*a*, 1*b*.

Unio atra DESHAYES, Enc. Meth., II, 1830, p. 582.

Unio lugubris SAY, Am. Conch., V, 1832, pl. XLIII; VI, 1834.

Unio poulsoni SOWERBY, Conch. Icon., XVI, 1866, pl. LI, fig. 270.

Unio dolosus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 307; Jl. Ac. N. Sci. Phila., V, 1862, p. 75, pl. IX, fig. 224; Obs., VIII, 1862, p. 79, pl. IX, fig. 224.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLI, fig. 228.

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

A magnificent shell, the finest and probably the largest *Lampsilis*. It seems to take the place of *L. alata* in the southwest. It is much more inflated than that species, is darker and more glossy, has a lower dorsal wing and richer nacre.

LAMPSILIS PERMISCENS (Lea).

Shell irregularly obovate, thin, subinflated, gaping at the posterior slope and anterior base, with moderate posterior wing and a full, widely rounded posterior ridge; beaks low and compressed, their sculpture not seen; epidermis smooth, smoky, olive to blackish, feebly rayed, darker on the posterior

slope; left valve with a long, low, feebly developed pseudocardinal, which is somewhat divided in the middle, and two remote, delicate laterals; right valve with a single compressed pseudocardinal and one high, truncated lateral; beak cavities shallow, with a row of pits; muscle scars superficial; nacre blue, becoming somewhat lurid at the beak cavities. The only shell I have seen is the type, which is probably a young female. It is somewhat rhomboid behind and well developed into a marsupial swelling at the extreme posterior base. The front end of the shell is narrow.

Length 55, height 37, diam. 20 mm.

Type locality, Tombigbee River, Columbus, Mississippi.

Unio permiscens LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 112; Jl. Ac. N. Sci. Phila., V, 1862, p. 102, pl. XVII, fig. 251; Obs., VIII, 1862, p. 106, pl. XVII, fig. 251.

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

Lampsilis permiscens SIMPSON, Syn., 1900, p. 569.

This is undoubtedly a young shell and not in the best condition. It is not unlikely that it is a young *L. purpurata*.

LAMPSILIS GOULDII (Lea).

Shell almost regularly elliptical, a very little wider behind than in front, subsolid, not inflated, with a low posterior ridge and two radiating, slightly raised, darker ridges above it; beaks probably not high, so eroded in the only specimen seen that nothing can be made out from them; posterior base a little full; surface with irregular growth lines, covered with a dark brown epidermis; left valve with two small pseudocardinals, the anterior slightly compressed, the posterior stumpy, and two remote, curved laterals; right valve with one pseudocardinal and one lateral; beak cavities not deep; muscle scars shallow, the hinder faint; nacre bluish-white, slightly thicker in front.

Length 50, height 29, diam. 17 mm.

Type locality, Tuscaloosa, Alabama.

Unio gouldii LEA, Pr. Am. Phil. Soc., IV, 1845, p. 165; Tr. Am. Phil. Soc., X, 1848, p. 76, pl. VI, fig. 16; Obs., IV, 1848, p. 50, pl. VI, fig. 16.

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

Lampsilis gouldii SIMPSON, Syn., 1900, p. 569.

I only know of a single specimen of this species, the type, and this consists of two fairly well matched, but badly eroded, dead valves, which probably come from young shells. The beak cavities each have a lurid bronze blotch, but do not exhibit, so far as I can see, any pits. The posterior end of the shell is slightly pointed and biangulate on the median line. The radial, dark ridges on the posterior slope are much like those of members of this group, and the shell has some resemblance to a young *umbrosa*, but I cannot be sure where it belongs.

Group of *Lampsilis saladoensis*.

Shell smooth, obovate, inflated, inequilateral, rounded behind, thin, slightly thicker in front; beaks somewhat prominent, nearly smooth; epidermis yellowish-olive, shining, rayed; there is a slight carina high up on the posterior slope; pseudocardinals small, lamellar and oblique; laterals lamellar and curved; anterior cicatrices distinct and well impressed; posterior cicatrices confluent; dorsal cicatrices under the plate, between the pseudocardinals and laterals; nacre bluish-white and iridescent. Animal unknown.

LAMPSILIS SALADOENSIS (Lea).

Shell obovate, rather thin, much inflated, with full, high beaks almost destitute of sculpture, with a full, somewhat double posterior ridge; rounded and narrowed in front with a slight postdorsal wing; surface pale yellowish-green in the young shell, olive-green when older, with numerous feeble, wide rays on the posterior half of the shell, which are evenly spaced; epidermis smooth and shining; left valve with a single, somewhat compressed pseudocardinal which may be bifid, and two remote, delicate laterals; right valve with two nearly equal pseudocardinals and one short, truncated lateral; beak cavities deep, not compressed; nacre bluish-white in the young shell, having a reddish-salmon tint in the cavity of the older shell; adductor scars shallow; dorsal scars apparently wanting. The female shell is quite narrow in front and has a wide, rounded, quite prominent marsupial swelling, which reaches forward to the

middle of the shell, and a very blunt, posterior point about on the median line. The male shell is not so full at the post-basal part, and ends in a blunt point behind midway up from the base.

Length (male) 53, height 35, diam. 26 mm.

Length (female) 30, height 22, diam. 13 mm.

Type locality, Rio Salado, New Leon, Mexico. Bayou Teche, Louisiana?

Unio saladoensis LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 305; Jl. Ac. N. Sci. Phila., IV, 1860, p. 370, pl. LXV, fig. 195; Obs., VIII, 1860, p. 52, pl. LXV, fig. 195.

Margaron (Unio) saladoensis LEA, Syn., 1870, p. 62.

Lampsilis saladoensis SIMPSON, Syn., 1900, p. 569.

At the time I wrote the Synopsis I had not seen an example of this shell. Since then I have examined a small female shell from Mexico, which agrees well with Dr. Lea's description of the above species, and another much larger, which is a male and no doubt belongs to the same species, which is said to come from Bayou Teche, Louisiana. The species evidently belongs in the subgenus *Proptera* but differs to quite a marked degree from all others. It is shorter, and more inflated than any other species in the subgenus, and is remarkable for its peculiar rays and the apparent want of dorsal muscle scars.

Group of *Lampsilis umbrosa*.

Shell solid, inflated, short elliptical, covered with a shining, rather smooth brownish epidermis, which often has microscopic, radiating folds; beak sculpture excessively faint, being the merest hint at a double loop, with the nacre at the anterior end suddenly thickened; that of the male scarcely differing from the female; hinge teeth well developed; pseudocardinals strong; laterals large, straight, and club-shaped; nacre whitish or purplish. Animal having the inner gills united to the abdominal sac; branchiæ large; marsupium occupying the whole outer gills posteriorly, not projecting much below; palpi large, considerably united behind.

LAMPSILIS UMBROSA (Lea).

Shell somewhat obovate, subsolid, subinflated, with rather low beaks, whose sculpture is very feeble; surface nearly smooth, nearly or quite rayless; epidermis dark brown or blackish; posterior ridge low, somewhat double, generally having a darker line on the upper ridge; left valve with two subcompressed, somewhat ragged pseudocardinals and two remote, curved, club-shaped laterals, the lower the larger; right valve with one pseudocardinal, a vestigial one above it and one club-shaped lateral; beak cavities shallow, with a few pits; muscle scars superficial, the posterior large; nacre white or purplish. Male and female shells much alike, ending behind in a slight biangulation one-third of the way up from the base; both shells are a little full in the posterior base, that of the female a little more produced.

Length 90, height 53, diam. 30 mm.

Vera Cruz, Mexico.

Unio umbrosus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 95; Jl. Ac. N. Sci. Phila., III, 1857, p. 311, pl. XXX, fig. 26; Obs., VI, 1857, p. 31, pl. XXX, fig. 26.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIII, fig. 170.—FISCHER and CROSSE, Miss. Sci., Pt. 7, II, 1894, p. 587, pl. LXVII, figs. 1, 1*a*, 1*b*.

Margaron (Unio) umbrosus LEA, Syn., 1870, p. 41.

Lampsilis umbrosus SIMPSON, Syn., 1900, p. 570.

Unio veracruzensis LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 150; Jl. Ac. N. Sci. Phila., VI, 1869, p. 320, pl. LII, fig. 133; Obs., XII, 1869, p. 80, pl. LII, fig. 133.

Margaron (Unio) veracruzensis LEA, Syn., 1870, p. 45.

Unio tampicoensis var. *umbrosus* VON MARTENS, Biol. Cent. Amer. Moll., 1900, p. 512, pl. XXXV, figs. 3-5*b*.

An abundant species, having a peculiarly rich texture. It is considerable less solid and inflated than *berlandierii*, but more inflated than *tampicoensis*.

The type of *veracruzensis* is in the Smithsonian collection, and is undoubtedly a very young *umbrosa*.

LAMPSILIS BERLANDIERII (Lea).

Shell somewhat rhomboid, inflated, solid, with full, high beaks, a large ligament and a very low wing; beak sculpture almost wanting; surface with irregular growth lines, nearly smooth, nearly or quite rayless, the young shell pale brownish, adult or old shells dark brown; posterior ridge rather high and rounded; left valve with two high, ragged pseudocardinals and two short, remote, club-shaped laterals; right valve with two pseudocardinals, the upper smaller, and one lateral; beak cavities full and deep, with a few scars under the shelf of the hinge; anterior muscle scars deep; posterior scars very large in adult shells, suborbicular; nacre purplish, much thicker in front. In both male and female shells the rounded posterior point is below the median line, the female shell is but very little fuller on the posterior base than that of the male.

Length 105, height 75, diam. 50 mm.

Northeastern Mexico; southwestern Texas.

Type locality, Matamoras and Tamaulipas, Mexico; Colorado River, Texas.

Unio berlandierii LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 101; Jl. Ac. N. Sci. Phila., IV, 1860, p. 369, pl. LXV, fig. 194; Obs., VIII, 1860, p. 51, pl. LXV, fig. 194.—REEVE, Conch. Icon. XVI, 1865, pl. XXIII, fig. 108.

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

Lampsilis berlandieri SIMPSON, Syn., 1900, p. 570.

A larger, solider, more inflated and more rhomboid shell than *umbrosa*, having higher, fuller beaks and larger, deeper beak cavities.

LAMPSILIS TAMPICOENSIS (Lea).

Shell subrhomboid, scarcely inflated, subsolid, with moderately full beaks, which have exceedingly faint sculpture, with a small, rounded posterior ridge; surface rather smooth, with a glossy, dark chestnut or blackish epidermis; left valve with two subcompressed pseudocardinals and two remote slightly curved laterals; right valve with two pseudocardinals, the lower the higher, and one lateral; beak cavities deep, compress-

ed, with a few pits under the hinder pseudocardinal, muscle scars superficial, the hinder large; nacre purple, iridescent, and thinner behind. The male and female shells are very much alike and they end in a faint, wide biangulation a short distance above the base.

Length 80, height 60, diam. 28 mm.

Another, length 120, height 76, diam. 50 mm.

Northeastern Mexico; southeastern Texas; Honduras.

Unio tampicoensis LEA, Tr. Am. Phil. Soc., VI, 1838, p. 24, pl. VII, fig. 18; Obs., II, 1838, p. 24, pl. VII, fig. 18.—CHENU, Ill. Conch., 1858, pl. XXI, figs. 5, 5*a*, 5*b*.—?KUSTER, Conch. Cab. Unio., 1862, p. 275, pl. XCIII, fig. 1.—?SOWERBY, Conch. Icon., XVI, 1867, pl. LVII, fig. 291.—VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 511, pl. XXIII, figs. 1, 1*a*, 1*b*.

Margarita (Unio) tampicoensis LEA, Syn., 1836, p. 22; 1838, p. 18.

Margaron (Unio) tampicoensis LEA, Syn., 1852, p. 26; 1870. p. 41.

Lampsilis tampecoensis SIMPSON, Syn., 1900, p. 570.

Unio heermannii LEA, Pr. Ac. N. Sci. Phila., XIII, 1861, p. 392; Jl. Ac. N. Sci. Phila., V, 1862, p. 194, pl. XXVI, fig. 263; Obs., IX, 1863, p. 16, pl. XXVI, fig. 263.—? SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIII, fig. 441.

Margaron (Unio) heermannii LEA, Syn., 1870, p. 28.

Close to *berlandierii* but less inflated and solid, with lower beaks, generally darker within and without. But there are intermediate shells that are hard to place. It attains larger dimensions than those given above. The female shell of *tampicoensis* is a little fuller behind the center of the base than the male is.

LAMPSILIS TECOMATENSIS (Lea).

Shell elliptical, somewhat inflated, solid, with moderate, faintly biangulate posterior ridges, with full, rather high beaks, whose sculpture is not known; epidermis thick, blackish, smooth and shining on the middle of the disk, a little roughened around the border and especially on the posterior slope,

dark reddish-brown or blackish, becoming olive-colored on the umbonal region; left valve with two strong, subtriangular pseudocardinals, which the rough above, and two somewhat remote laterals, the upper smaller; right valve with three pseudocardinals, the central one large and triangular, the other two faint; beak cavities moderate, with a row of dorsal scars under the hinge; anterior cicatrices well impressed; posterior cicatrices large, distinct; nacre dark, lurid purple, with a coppery iridescence behind, thicker in front. The only specimen I have seen, the type, is probably a male and is very slightly rhomboid, being feebly and widely biangulate behind near the base; basal line rounded.

Length 90, height 60, diam. 40 mm.

Rio Cosamaloapam, Chacotianguis; Tecomate River, Mexico.

Unio tecomatensis LEA, Pr. Am. Phil. Soc., II, 1841, p. 30; Tr. Am. Phil. Soc., VIII, 1842, p. 234, pl. XXI, fig. 48; Obs., III, 1842, p. 72, pl. XXI, fig. 48.—CHENU, Ill. Conch., 1858, pl. XXXI, figs. 6, 6*a*, 6*b*.—FISCHER and CROSSE, Miss. Sci., Pt. 7, II, 1894, p. 589, pl. LXV, fig. 6; LXVI, figs. 4, 4*a*.

Margaron (Unio) tecomatensis LEA, Syn., 1852, p. 27; 1870, p. 50.

Lampsilis tecomatensis SIMPSON, Syn., 1900, p. 571.

This is not so rhomboid a shell as *L. berlandierii*, nor so much inflated; its beaks are lower, and it has a darker epidermis and nacre. It is shorter, more inflated, rather solider than *tampicoensis*, and has a darker nacre.

LAMPSILIS LIVIDA Simpson.

Shell elongate, somewhat obovate, rather thin; anterior end compressed, ridge striated; posterior end subtruncated above, concentrically finely ridged; beaks quite full and high, placed in front of the middle; epidermis smooth, livid olive, much lighter on the beaks. The specimen figured in the Conchologia is probably a female and has a slight, elongated, rounded swelling along the posterior base; it is faintly biangulate be-

hind at the end of the somewhat double posterior ridge, the extreme posterior point being just below the median line.

Length 110, height 62 mm.; diameter not given.

Rio Usumasinto, Portugal, according to Reeve, who no doubt intended this for Rio Usumacinta, Mexico, and Guatemala.

Unio testudineus REEVE, Conch. Icon., XVI, 1865, pl. XXII, fig. 101.

Unio explicatus FISCHER and CROSSE, Miss. Sci., Pt. 7, II, 1894, p. 594.

Lampsilis lividus SIMPSON, Syn., 1900, p. 571.

Very close to *L. explicata*, Morelet, and believed to be that species by Fischer and Crosse in the Mission Scientifique. It is somewhat obovate, while the *explicata* holds the same width throughout; it has much fuller, higher beaks, and Sowerby states that it is a thin shell, while specimens of *explicata* of the size of Sowerby's figure are rather solid. If his specimen is a female, as I suspect it is, the marsupial swelling is less developed and quite different from that of *explicata*. I have recently seen a left valve of a shell sent by Dr. von Ihering from the Rio Lacantun, Chiapas, Mexico, which agrees well with Reeve's figure of *U. testudineus* and is more inflated and less high than specimens of *Lampsilis explicata* in the National Museum collection. This valve measures 82 millimeters in length, 43 in height, and shows the shell to be 28 millimeters in diameter. I have no doubt but that it is the *testudineus* of Reeve and that it differs from the *L. explicata* of Morelet.

LAMPSILIS EXPLICATA (Morelet).

Shell large, subrhomboid or long elliptical, rather solid, subinflated, with a large brown ligament; beaks moderately full and high, their sculpture scarcely developed; posterior ridge moderate, sometimes rounded, sometimes a little angular; surface with concentric growth lines, which are strong anteriorly but almost fade out in the middle of the shell; color smoky-brown, paler in young shells, darker in old specimens, the umbonal region lighter and livid; left valve with two small,

compressed pseudocardinals, the anterior the higher, and two remote laterals; right valve with one pseudocardinal, a vestigial one above it, and one granular lateral; beak cavities deep with an irregular, double row of dorsal pits; anterior scars moderately impressed; posterior scars shallow, large; nacre white or pale purplish, thicker in front. The male shell is somewhat rhomboid, the posterior termination being widely rounded and below the median line; the female shell has a small marsupial swelling at some distance in front of the posterior end; the posterior termination is nearly midway up from the base.

Length 112, height 70, diam. 45 mm.

Central America; Tabasco, Mexico.

Unio explicatus MORELET, Test. Noviss, Pt. 1, 1849, p. 28.—FISCHER and CROSSE, Miss. Sci., Pt. 7, II, 1894, p. 594, pl. LXI, fig. 1.

Lampsilis explicatus SIMPSON, Syn., 1900, p. 571.

Margaron (Unio) semigranosus LEA, Syn., 1870, p. 34.

A fine series of this species has been lately received by the National Museum from Tabasco, Mexico, collected by Messrs. Nelson and Goldman.

LAMPSILIS SAPPERI von Ihering.

"This is the shell mentioned by Simpson in his Catalogue, p. 571, n. 4, as a doubtful variety of *L. explicatus*. The shell is more elongate, with the ventral margins sinuate and the anterior extremity lower and somewhat obliquely truncate on the inferior part of the anterior margins. The pseudocardinals are very stout, one in the right, two in the left valve. This differs remarkably from *L. explicatus* as figured by Crosse and Fischer, pl. 61, fig. 1, of the Moll. Mex., having the pseudocardinals elevated, compressed, lamelliform. I believe the *L. sapperi* more allied to *L. umbrosus* Lea than to *explicatus*, being, however, of a more elongate form with produced posterior extremity and larger size. The type example has a length of 64 mm., breadth of 114 mm., diam. of 38 mm. The epidermis is dark brown, blackish, the nacre white. The posterior slope

has two obtuse, somewhat indistinct diverging lines. The species is from the Chixoy River, in Guatemala, and dedicated to Dr. Carl Sapper, who has collected, in scientific expeditions in Central America and Mexico, many interesting *Unionidæ,* for which I am much indebted to him." (von Ihering.)

Lampsilis explicatus, SIMPSON, Syn., 1900, p. 571, n. 4.

Lampsilis sapperi VON IHERING, Naut., XV, 1901, p. 50.

LAMPSILIS FIMBRIATA Frierson.

"Shell large, elliptical, thin and compressed. Dorsal line incurved in front of the beaks. Anterior margin somewhat obtruding, obtusely pointed or sharply elliptically curved. Basal margin nearly straight, occasionally slightly arcuated. Posterior margin broadly, roundly biangular. Beaks low and without sculpture. Posterior ridge elevated, rounded and obsolete. The greatest diameter of the shell being about the center of the ridge. Sides flattened and generally somewhat constricted in the middle. Behind the posterior ridge, down the siphonal area extends a raised line, enclosing a triangular area, (having its apex at the beak), which is sculptured with small pustules arranged in upturned lines. Epidermis yellow, horn-color, sometimes obsoletely rayed on the posterior slope. The shell would seem to be nearly smooth, but in all the specimens seen there are numerous irregular, radial, pit-like impressions and concentric striæ and shallow sulci. The radial impressions, or pits, extend through the shell and are visible inside and out. Hinge ligament stout and rather long. Muscle scars well marked, separate in front and confluent behind. Teeth stout, double in the left and single in the right valve. Beak cavities shallow, with a row of muscle scars running downward, forward and onto the base of the cardinal tooth. Nacre white, flesh-color or dark purple, very irregularly laid on and very thin. Except in old shells, the prismatic structure extends far beyond the nacre and the epidermal layer, in turn, extends still further.

Length 80, height 47, diam. 25 mm." (Frierson.)

Type locality, Valles River, Mexico.

Lampsilis fimbriata FRIERSON, Naut. XXI, 1907, p. 86, pl. XII, two upper figures and lower left-hand figure.

Paraptera (?) fimbriata ORTMANN, Ann. Car. Mus., VIII, 1912, p. 332.

Lampsilis salinasensis SIMPSON, Pr. U. S. Nat. Mus. XXXV, 1908, p. 181, pl. XXX, fig. 3.

"The shell is not related very closely to any species that I know of. In fact I am undetermined whether to place it in *Lampsilis* or in *Nephronaias*. In the absence of any data regarding the animal, it is provisionally placed in *Lampsilis*. The prismatic layer is 3-16 inch wide at the edge in some cases. This peculiarity accounts for the *pitting*, and numerous irregular sulcations being, it is evident, not normal, but the result of numerous accidents, which befall the extremely delicate edge of the shell. The two upper figures represent the type specimen; the lower left-hand figure is a young shell."

LAMPSILIS ALIENIGENA (Crosse and Fischer).

Shell evenly long elliptical, subinflated, solid, with a very low, somewhat double posterior ridge, which ends behind in a slight biangulation at the median line; with a very imperfectly developed wing; ligament large; epidermis brilliant brown-olive with very feeble rays; beaks moderately full, apparently not high; hinge rather delicate; left valve with two compressed, ragged pseudocardinals and two long laterals; right valve with two pseudocardinals, the upper smaller and one long lateral; muscle impressions shallow; nacre rose-color.

Length 82, height 51, diam. 30 mm.

Goatzalcoalcos, Vera Cruz, Mexico.

Unio alienigenus CROSSE and FISCHER, Jl. de Conch., XLI, 1893, p. 294.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 590, pl. LXV, figs. 5, 5*a*; pl. LXVI, fig. 3.—VON MARTENS, Biol. Cent. Am. Moll., 1900, p. 513, pl. XXXV, fig. 2-2*a*.

Lampsilis alienigenus SIMPSON, Syn., 1900, p. 572.

I have only seen a young male specimen of what I refer to this species with doubt, and this is considerably decorticated.

The figures in the Mission Scientifique represent adult males probably, which are scarcely produced at all on the posterior base, and have an evenly rounded posterior outline save for a slight biangulation midway up from the base. It is a more evenly elliptical shell than *umbrosa,* but not so elongated as *livida.* von Martens figures a smaller female shell, which he refers to this species and this has a moderate marsupial swelling.

Group of *Lampsilis metallica.*

Shell rather small, obovate-rhomboid, inflated, much narrowed and rounded in front, the form approaching that of a *Modiolus;* epidermis a rich coppery bronze, shining; beak sculpture consisting of two faint, rounded loops, the bars of which are inclined to be nodulous; pseudocardinals compressed, not well developed, and sometimes more or less broken into denticles; laterals distinct; pits in the beak cavity numerous and very irregular; nacre dark, coppery to purple, with metallic tints, iridescent behind. Animal unknown.

LAMPSILIS METALLICA (Say).

Shell small for the group, scarcely inflated, thin but strong, subrhomboidal, with a very faint post-dorsal wing, the hinder part of the posterior slope obliquely truncated; beaks low, rather full, with a few broken, doubly-looped ridges, the loops rounded below; posterior ridge high, very wide and rounded; surface nearly smooth, shining, metallic copper-colored; left valve with two subcompressed pseudocardinals and two delicate, remote laterals; right valve with one pseudocardinal, a vestige of another above it and one lateral; beak cavities shallow, containing a few indistinct pit marks; nacre rich copper-colored, iridescent and thinner behind. I have seen only what I presume to be male shells of this somewhat rare species and these are somewhat rhomboid, being truncated on the posterior slope, the posterior end widely rounded below. The base line is very slightly curved and the anterior end is rounded and narrowed.

Length 48, height 28, diam. 17 mm.

Mexico; no special locality is recorded with certainty. The habitat, Lake Chalco in the State of Mexico, given by Say, is very much doubted by Fischer and Crosse.

Unio metallicus SAY, N. Harm. Disseminator (newspaper form), January 15, 1831,; Am. Conch., VI, 1834.

Lampsilis metallicus SIMPSON, Syn., 1900, p. 572.

Unio cuprinus LEA, Tr. Am. Phila. Soc., IV, 1831, p. 94, pl. XII, fig. 24; Obs., I, 1834, pl. XII, fig. 24.—HANLEY, Biv. Shells, 1843, p. 208, pl. XXII, fig. 7.—CHENU, Ill. Conch., 1858, pl. XI, figs. 3, 3*a*, 3*b*.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXVI, fig. 336.

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

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

Unio æreus REEVE, Conch. Icon., XVI, 1856, pl. XXX, fig. 160.

A beautiful little species with a shining, coppery epidermis and a rich metallic nacre, which cannot be mistaken for any other.

Var. *ganina* Pilsbry.

"The shell resembles *L. metallica* (Say) (*Unio cuprinus* Lea) in general appearance, but is constantly smaller, more compressed and more reniform. Near the beaks there are green rays on a pale ground, the rest of the valve being brownish-black.

Length 47, height 25, diam. 13½ mm.

Length 47½, height 26½, diam. 16 mm.

Length 39, height 21, diam. 13 mm." (Pilsbry.)

Type locality, Ganina River, three miles southwest of San Dieguito, Mexico.

Lampsilis metallica ganina PILSBRY, Pr. Ac. N. Sci. Phila., 1909, p. 539, pl. XXVII, fig. 6.

Var. *subventralis* (von Martens).

"Ventral margin distinctly convex. Vertices in 2/9 long.

Length 55, alt. vert. 29, alæ 29, diam. 18 mm.

Type locality, Southeast Mexico: Tabasco." (von Martens.)

Unio cuprinus subventralis VON MARTENS, Biol. Cent. Amer. Moll., 1900, p. 506, pl. XXXVI, figs. 1, 1*a*, 1*b*.

Group of *Lampsilis gracilis.*

Shell large, thin, elliptical or slightly obovate, with a high posterior and an anterior wing, not greatly inflated; beaks low; epidermis rather smooth, often feebly rayed, dull colored, but usually glossy; hinge line slightly and rather regularly curved; teeth compressed, pseudocardinals but feebly and often imperfectly developed; nacre purplish-tinted, dull. Shell of the male and female nearly alike, the latter scarcely swollen at post-basal region. Animal having the mantle greatly thickened at the posterior end, and double and thickened at the post-base, where it is often crenulate or toothed on its inner border, and has the outer developed into a flap; inner gills united to the abdominal sac throughout; marsupium enormous, composed of a great number of delicate, semiradiating ovisacs, projecting far below the inner gills in a semicircle.

LAMPSILIS GRACILIS (Barnes).

Shell large, thin, obovate, subcompressed to subinflated, with generally low compressed beaks having very feeble sculpture, which shows a tendency to be doubly looped; posterior ridge almost wanting, there being two or sometimes three radial raised lines on the posterior slope; there is a moderately developed posterior wing, which is broken away in adult specimens showing the long ligament, and in front of the hinge the young shell is angular; surface rather smooth, with faint, irregular growth lines, greenish-yellow or pale smoky-brownish, sometimes feebly rayed, often rayless, the posterior slope dark green and generally rayed; left valve with two feeble, compressed pseudocardinals and two remote, often imperfect, laterals; right valve with one pseudocardinal and one truncate lateral; beak cavities shallow, showing a row of ill-developed muscle scars running in the direction of the retractor muscle scar; adductor scars large, faint, the anterior irregular; nacre faint purplish and bluish. Generally the male and female are much alike, the former is sometimes a little rhomboid and again it ends in a wide, rounded point about on the median

line. The female shell is a little fuller and more rounded on the post-basal region, and sometimes has a well-developed marsupial swelling.

Length 138, height 80, diam. 37 mm.

Entire Mississippi River drainage; St. Lawrence system; Red River of the North; Hudson River; eastern Texas.

Type locality, Wisconsin River and "the lakes."

Unio gracilis BARNES, Am. Jl. Sci., VI, 1823, p. 274.—DESHAYES, Tr. Element. Conch., 1839, p. 18, pl. XXX, figs. 2, 3.—HANLEY, Biv. Shells, 1843, p. 174, pl. XX, fig. 37.—DESHAYES, Tr. Elem., II, 1853, p. 217, pl. XXX, figs. 2, 3.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIX, fig. 215.

Mya gracilis EATON, Zool. Text-Book, 1826, p. 222.

Symphynota gracilis LEA, Tr. Am. Phil. Soc., III, 1830, p. 452; Obs., I, 1834, p. 66.

Margarita (Unio) gracilis LEA, Syn., 1836, p. 11; 1838, p. 13.

Metaptera gracilis STIMPSON, Shells of N. Eng., 1851, p. 14.

Margaron (Unio) gracilis LEA, Syn., 1852, p. 19; 1870, p. 28.

? Anodon gracilis SOWERBY, Sowerby's Genera, No. XVII, 1823, fig.

Lampsilis gracilis BAKER, Moll. Chicago, Pt. I, 1898, p. 99, pl. XIX, fig. 1.—SIMPSON, Syn., 1900, p. 573.

Paraptera gracilis ORTMANN, Ann. Car. Mus., VIII, 1912, p. 331.

Unio fragilis SWAINSON, Zool. Ill., 1st ser., III, pl. CLXXI, 1823.—CONRAD, Monog., VI, 1836, p. 55, pl. XXX.—KUSTER, Conch. Cab. Unio, 1852, p. 19, pl. III, fig. 1.

Symphynota fragilis FERUSSAC, Guer. Mag., 1835, p. 25.

Metaptera fragilis CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 260.

Unio fragilis var. *gracilis* PÆTEL, Conch. Sam., III, 1890, p. 153.

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

Unio planus CONRAD, New F. W. Shells, 1834, p. 71.

Unio (Niäa) atrata SWAINSON, Zool. Ill., 1841, pl. CLXXI.

Unio atratus HANLEY, Test. Moll., 1842, p. 199; Biv. Shells, 1843, p. 199, pl. XXI, fig. 29.

Thinner and more evenly elliptical, with a less developed marsupial swelling than *alata,* and it has much lighter colored nacre. It is more elongated, is duller colored and has a less developed wing than *lævissima.*

Ortmann, (Mem. Car. Mus., IV, 1911, p. 334), has made this species the type of a new genus, *Paraptera,* based on the shape of the glochidia, which are of the usual Lampsiline type, without spines and very small.

LAMPSILIS LÆVISSIMA (Lea).

Shell, without the wings, nearly evenly elliptical, a little wider behind with a decided posterior and anterior basal gap, thin, subcompressed, strongly alate, having a very high, triangular posterior wing that is often flexed at the top, and a smaller anterior wing; beaks subcompressed, not high, with a few nodulous, broken, slightly-looped ridges; surface with numerous irregular growth lines and sculptured in fine specimens with delicate radiating liræ, smoky-olive, lighter at the beaks, the rest bands dark, brilliantly polished; left valve with one or two feeble, compressed pseudocardinals and two remote, delicate laterals; right valve with one pseudocardinal, sometimes a faint one above it, and a high, truncated lateral; beak cavities shallow, with an irregular row of shallow scars; adductor scars large and shallow; nacre purplish. The male and female shells are so near alike that it is often difficult to separate them. The male shell is generally slightly rhomboid behind and the female is a very little fuller along the base than the male.

Length 120, height without measuring the wing 76, diam. 37 mm. The wing when well preserved in adult shells is about 25 mm. in height.

Mississippi drainage generally; eastern Texas; southern Michigan; western New York.

Type locality, Ohio.

Symphynota lævissima LEA, Tr. Am. Phil. Soc., III, 1830, p. 444, pl. XIII, fig. 23; Obs. I, 1834, p. 58, pl. XIII, fig. 23.

Unio lævissima DESHAYES, An. sans Vert., 2d ed., VI, 1835, p. 558.

Unio lævissimus CONRAD, New F. W. Shells, 1834, p. 70.—HANLEY, Biv. Shells, 1843, p. 174, pl. XXI, fig. 41.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLVI, fig. 250.

Margarita (Unio) lævissimus LEA, Syn., 1836, p. 11; 1838. p. 13.

Margaron (Unio) lævissimus LEA, Syn., 1852, p. 19; 1870, p. 28.

Lampsilis lævissimus SIMPSON, Syn., 1900, p. 574.

Proptera lævissima ORTMANN, Ann. Car. Mus., VIII, 1912, p. 324.

Unio ohioensis SAY, Am. Conch., VI, 1834.—KUSTER, Conch. Cab., 1866, p. 20, pl. LXIX, fig. 5.

Symphynota ohioensis FERUSSAC, Guer. Mag.; 1835, p. 25.

Metaptera ohiensis CONRAD, Pr. Ac. N. Sci. Phila., VI., 1853, p. 260.

Unio discoideus SOWERBY, Conch. Icon., XVI, 1866, pl. LIII, fig. 275.

Generally a little less elongated and more brilliant than *L. gracilis,* and it has feeble radial sculpture and a higher wing. Its nacre is usually darker than that of *gracilis.*

LAMPSILIS INFLATA (Lea).

Shell somewhat trapezoidal, being truncate on the posterior slope and narrowed in front, thin, subinflated, having its greatest diameter just behind the center; dorsal wing probably high in young shells; posterior ridge high and widely rounded; beaks low and compressed, their sculpture not seen; epidermis greenish-olive to dark brownish, scarcely shining, nearly or quite rayless; in young shells there is often one or two faint, wide, dark rays on the posterior slope; left valve with a feebly developed, elongated pseudocardinal and two short, remote laterals; right valve with one faint, elongated pseudocardinal and one high, short, truncated lateral; beak cavities shallow, with a row of irregular, large scars; adductor scars shallow, the anterior ones large; nacre rich purple, iridescent behind. There seems to be but little difference between shells of the male and female.

Length 105, height from broken point of wing 78, without the wing 72, diam. 38 mm.

Alabama and Tombigbee River areas.

Type locality, Alabama River.

Symphynota inflata LEA, Tr. Am. Phila. Soc., IV, 1831, p. 99, pl. XIV, fig. 28; Obs., I, 1834, p. 109, pl. XIV, fig. 28.

Metaptera inflata CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 260.

Margarita (Unio) inflatus LEA, Syn., 1836, p. 11; 1838, p. 13.

Unio inflatus CONRAD, Monog., VII, 1836, p. 57, pl. XXXII.—HANLEY, Biv. Shells, 1843, p. 174, pl. XXI, fig. 45.—KUSTER, Conch. Cab. Unio, 1852, p. 17, pl. II, fig. 1.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLV, fig. 246.

Margaron (Unio) inflatus LEA, Syn., 1852, p. 28; 1870, p. 28.

Unio alabamensis CONRAD, New F. W. Shells, 1834, p. 67.

Lampsilis alabamensis SIMPSON, Syn., 1900, p. 574.

Most nearly related to *L. lævissima,* but it is not evenly elliptical and it has a much higher posterior ridge than that species. It has a decided anterior basal and posterior gape, the latter in the specimen above measured being 7 millimeters across.

Lea originally described this species as *Symphynota inflata,* so that in *Lampsilis* his name is entitled to precedence, notwithstanding Barnes' *Unio inflatus* described in 1823.

Group of *Lampsilis amphichæna.*

Shell rather thin, elongate, elliptical, rounded before, pointed behind, compressed, with a smooth, shining, black, rayless epidermis; beaks not prominent, their sculpture unknown; there is a conspicuous gape at the anterior base, and another very distinctly outlined at the upper part of the posterior end like that of *Schizothærus;* hinge line slightly curved; pseudocardinals imperfect; laterals compressed; nacre purplish; female shell inflated at posterior base.

Animal with large, elliptical palpi; mantle slightly thickened at the edge; anal opening widely separated from the superanal, the latter large; foot large, hatchet-shaped. Several animals were examined, but all were so much decayed that most of the characters could not be made out.

LAMPSILIS AMPHICHÆNA Frierson.

Shell large, long elliptical, subinflated, subsolid, with moderately full, but not high, beaks, whose sculpture has not been seen; with a long, narrow gape on the anterior base and a most decided one behind just above the posterior point; posterior ridge full, rounded; surface with irregular growth marks; epidermis dark brown to jet black, smooth and shining on the middle of the disk, somewhat roughened and lamellar on the rest of the shell, especially on the posterior slope; left valve with one rather feeble, subcompressed pseudocardinal and a vestigial second one in front of and below it, with two short, very remote laterals; right valve with one pseudocardinal, sometimes with a smaller one above it, and a remote lateral, whose inner edge is curved upward; beak cavities shallow, with an irregular row of large muscle scars running down towards the anterior base; anterior scars large, shallow; posterior scars small, somewhat elongated; pallial line wide, with a distinct sinus behind; nacre bluish and purplish, somewhat clouded. The female shell differs but slightly from that of the male, being a little fuller just behind the middle of the base and having the blunt posterior point a trifle higher.

Length 120, height 70, diam. 45 mm. The above measurements are from a large male shell.

Type locality, Saline River, Texas.

Unio (Lampsilis) amphichænus FRIERSON, Nautilus, XI, 1898, p. 10, pl. 1.

Lampsilis amphichænus SIMPSON, Syn., 1900, p. 575.

This is really a remarkable species, the great and distinct posterior gape resembling that of a *Schizothærus nuttalli*. In the specimen, whose measure is given above, it is about 10 millimeters wide. The anterior basal gap is narrower but ex-

tends to near the extreme posterior base of the shell, becoming narrower behind, and between it and the posterior opening the two valves touch only for a very short distance.

Group of *Lampsilis simpsoni*.

Shell long, obovate, gaping in front and behind, rounded at each end; epidermis dull, rayed when young, dark when adult; teeth very much reduced; nacre bluish or purplish.

Animal unknown.

LAMPSILIS SIMPSONI Ferriss.

Shell subsolid, elongated, slightly obovate, narrowed in front and rather evenly rounded at both ends, somewhat inflated, having the greatest diameter in the middle and gradually tapering each way to the ends, feebly gaping at the anterior base and at the posterior end; beaks rather low but distinct, their sculpture consisting of ill-defined, irregular, subnodulous corrugations; epidermis in the young projecting beyond the shell all around, showing the uneven growth lines; color tawny, with green rays and coppery beaks in the young, brownish or blackish in the adult; posterior ridge well marked in the earlier stages of growth; hinge line evenly curved; pseudocardinals reduced to mere stumpy vestiges; there are two feeble remote laterals in the left valve and one in the right; epidermal matter folded in along the hinge line; anterior cicatrices rather deep, irregular; posterior cicatrices shallow; nacre shaded violet, bluish and coppery, iridescent behind. I cannot tell whether the specimen figured is a male or female.

Length 95, height 50, diam. 32 mm.

Type locality, Spring River, Hardy, Arkansas.

Lampsilis simpsoni FERRISS, Nautilus, XIV, 1900, p. 38, fig.

This is perhaps most closely related to *L. leptodon* and *amphichæna*, though it resembles to some extent *L. gracilis*. Its teeth are much more feebly developed than those of the latter and it is a longer shell. The young are more like those of *leptodon*, but the mature shell is very different from that.

Group of *Lampsilis leptodon*.

Shell rather thin, elongate, elliptical, compressed, decidedly pointed behind, the point raised above the center of the shell; beaks low, their sculpture very feeble; there is a conspicuous post-dorsal wing in young shells, and sometimes vestiges of an anterior wing; young shell rather dull and faintly rayed; there is a decided anterior basal and posterior gape; hinge teeth very imperfect; pseudocardinals often almost wanting, even in young shells; laterals faint, sometimes wanting in the adult shell; nacre coppery to purplish; female shell not inflated at post-base. Animal having the branchiæ large, very thin, light brown, free nearly the whole length of the abdominal sac; palpi large, thin, nearly semicircular; mantle thin, with a wide crenulate border; marsupium projecting slightly below the inner gills.

LAMPSILIS LEPTODON (Rafinesque).

Shell irregularly long ovate, the dorsal line being generally more nearly straight than the basal line, very inequilateral, thin to subsolid, rather compressed, with a low, narrowly rounded posterior ridge, slightly winged behind when young, the wing mostly disappearing in adult shells, gaping at the anterior base and behind; beaks low, rather compressed, their sculpture consisting of a few very faint, doubly-looped ridges; surface covered with wide, very uneven, often sulcate, growth lines, greenish, olive-green, or in old shells brownish, with wide, feeble green rays; epidermis not shining; there is a very feeble, low tubercle under or in front of the beaks in each valve, but it is sometimes wholly wanting; left valve with the faintest vestige of one or two remote laterals; right valve with a stronger single lateral; beak cavities shallow with a row of irregular, large dorsal scars; anterior adductors long, vertical; posterior adductors large; nacre purple, bluish or salmon-color, often clouded. The male and female differ but little; those of the latter have a slightly fuller base, and the rather sharp posterior point is a little higher than in that of the male.

Length 117, height 60, diam. 28 mm.

Upper Mississippi River drainage, south to the Tennessee River; Buffalo, New York; southern Michigan; Souris River, Manitoba.

Type locality, lower Ohio River.

Unio (Leptodea) leptodon RAFINESQUE, Ann. Gen. Sci. Phys. Brux., V, 1820, p. 295, pl. LXXX, figs. 5-7.

Unio leptodon SAY, Am. Conch., VI, 1834.— CONRAD, Monog., VII, 1836, p. 58, pl. XXXIII.— CHENU, Bib. Conch., 1st ser., III, 1845, p. 12, pl. 1, figs. 5-7.—KUSTER, Conch. Cab. Unio, 1861, p. 197, pl. LXIV, figs. 1, 2.— SOWERBY, Conch. Icon., XVI, 1866, pl. XLVIII, fig. 257.

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

Leptodea leptodon CONRAD, Pr. Ac. N. Sci. Phila, VI, 1853, p. 262.

Lampsilis leptodon SIMPSON, Syn., 1900, p. 575.

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

Unio velum SAY, New Harm. Disseminator, II, September 23, 1829, p. 293.

Symphynota tenuissima LEA, Tr. Am. Phil. Soc., III, 1829, p. 453, pl. XI, fig. 21; Obs., I, 1834, p. 67, pl. XI, fig. 21.

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

Unio tenuissimus HANLEY, Biv. Shells, 1843, p. 206, pl. XX, fig. 42.— SOWERBY, Conch. Icon., XVI, 1866, pl. XLIV, fig. 240.

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

A peculiar shell of irregular growth. When viewed from above or below it will be seen that the parting line between the valves is never straight, the shell being more or less twisted to the left or the right or both ways as in the genus *Pseudospatha*. The anterior and posterior openings are very uneven and quite large. The teeth are rudimentary and in some specimens almost entirely wanting.

LAMPSILIS BLATCHLEYI Daniels.

"Shell long, elliptical or obovate, compressed, thin, inequilateral, slightly gaping behind; beaks low, but little inflated, pointed, with minute, nodulous sculpture; dorsal and basal outlines lightly curved; anterior end somewhat narrowed, rounded; posterior end rounded, and lightly and obliquely subtruncate above; surface with singular (regular?) growth lines; epidermis somewhat concentrically wrinkled, projecting beyond the border of the shell, yellow-green with faint green rays; pseudocardinals rudimentary, smooth, subcompressed; laterals straight, single in the right valve, partly double in the left; nacre brilliant, iridescent, having a somewhat coppery lustre in the cavities, becoming very thin and greenish at the edges.

Length 45, height 21, diam. 10 mm.

Length 40, height 17, diam. 8.5 mm.

Soft parts: Marsupium very large, occupying the posterior two-thirds of the outer gills, each lobe containing apparently about forty narrow ovisacs, the whole rounded and projecting well below the inner gills; inner gills united to the abdominal sac throughout their length; palpi large, elliptical, projecting backward but little; mantle much thickened on the border, its edges being decidedly double wavy and dark colored; branchial opening rather large, with stout papillæ; anal opening small, crenulate; super-anal opening long, closed below; foot rather large." (Daniels).

Type locality, Wabash River, Linn Township, Posey Co., Ind. Also, Hardy, Ark. (?) and Iowa River, Iowa City, Ia.(?)

Lampsilis blatchleyi DANIELS, Naut., XVI, 1902, p. 13, pl. 11.

"The species is closely allied to *L. leptodon* Raf., particularly in its anatomical characteristics; the shell differs from that species by not having the wing and by the posterior end being rounded and in the full-grown shell being not more than one-half the size."

Group of *Lampsilis scutulata.*

Shell rhombic elliptical, compressed, rather thin, with a high posterior and a low anterior wing, with two posterior ridges; the valves often exhibiting fine radiating plications on the posterior part; beaks compressed but very sharp pointed, sometimes showing the nepionic shell, almost destitute of sculpture, which, when present, consists of faint indications of two rounded loops; epidermis rather dull, sometimes indistinctly rayed; left valve with two pseudocardinals, the anterior a sharp, straight ridge sloping obliquely downward and forward from a point just in front of the beaks, the hinder curiously compressed and showing a tendency to break into denticles; right valve with two sharp, ridge-like, sloping pseudocardinals; laterals slender, compressed, straight, or wavy; nacre bluish-white to pale violet; dorsal scars few; female shell apparently slightly swollen at the posterior base; animal unknown.

LAMPSILIS SCUTULATA (Morelet).

Shell elliptical or elliptic-rhomboid, compressed, thin, green or light olive-green, with a few faint rays, with a low but distinct, somewhat angled posterior ridge, which is sometimes double; surface of the posterior half of the shell with slightly curved, nearly vertical plications; beaks low, not inflated; posterior wing well developed, angled behind; left valve with two pseudocardinals, the posterior small, and two laterals; right valve with two compressed pseudocardinals and one lateral; nacre bluish on the border, yellowish in the centre of the shell. Both male and female shells are somewhat rhomboid, the former more truncated at the posterior slope. The male shell ends in a blunt point, but a short distance above the base, and the base line is nearly evenly curved; the female shell is biangulate behind and has a well-developed marsupial swelling at some distance in front of the posterior end.

Length 49, height 30, diam. 16 mm.

Yucatan.

Unio scutulatus MORELET, Test. Noviss., I, 1849, p. 30.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 561, pl. LIX, fig. 5; LXVII, fig. 6.

Lampsilis scutulatus SIMPSON, Syn., 1900, p. 576.

This species, *L. planivalvis* and *L. paludosa*, are very closely related and may be mere variations of one thing. This has strong, nearly vertical, ribs on the posterior half of the shell and the male shells are more round on the base than those of either of the other species. *L. paludosa* has a higher wing than either of the other forms and is shorter than *planivalvis*.

LAMPSILIS PALUDOSA (Morelet).

Shell winged, inequilateral, oval-trapezoidal, compressed, thin, with a greenish-olive epidermis; surface covered with concentric growth lines, slightly radiately sculptured on the umbonal region; beaks low but sharp, not inflated, with delicate, doubly-looped sculpture; posterior ridge well developed and angled; anterior end rounded, angled at the dorsal line; posterior wing considerably developed and angled behind; the shell is decidedly and obliquely truncated posteriorly; post-basal part sub-biangulate; left valve with two pseudocardinals, the hinder rudimentary, and two lamellar laterals; right valve with two pseudocardinals, the upper the smaller, and one lateral; beak cavities shallow; nacre pale violet-rose; anterior muscle scars superficial; posterior scars indistinct.

The specimen described is probably a male; its basal line is nearly straight and it is considerably rhomboid.

Length 57, height 31, diam. 15 mm.

Yucatan.

Unio paludosus MORELET, Test. Noviss., I, 1849, p. 30.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 559, pl. LIX, fig. 3.

Lampsilis paludosus SIMPSON, Syn., 1900, p. 576.

A fine, compressed species with a small, angular wing in front and a larger one behind. It is nearly smooth, the posterior slope, however, sometimes has a few plications. It is more inflated and shorter than *planivalvis* and does not have such high wings as *delphinulus*.

LAMPSILIS PLANIVALVIS (Morelet).

Shell somewhat elongated, rhomboid, greatly compressed, with a slight wing in front and a moderately developed one behind, with a low, but distinct, angular posterior ridge; beaks low, not inflated, but sharply pointed; surface with fine growth lines and slightly radially ridged in the umbonal region; epidermis brown-olive; left valve with a thick anterior pseudocardinal, and an almost obsolete posterior one, with two lamellar laterals; right valve with two short pseudocardinals, the upper smaller, and a long, curved lateral; muscle scars shallow; beak cavities not deep; nacre white.

Length 66, height 35, diam. 14 mm.

Usumacinta River, Guatemala.

Unio planivalvis MORELET, Test. Noviss., II, 1851, p. 24.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 560, pl. LIX, fig. 2.

Lampsilis planivalvis SIMPSON, Syn., 1900, p. 576.

This species is greatly compressed, and has a decided wing in front and behind on the dorsal portion. Like all the other species of the group the general surface of the umbonal region is compressed, but the beaks themselves are elevated into a fine point.

The shell figured by Fischer and Crosse is probably that of a male.

LAMPSILIS DELPHINULUS (Morelet).

Shell with a somewhat triangular outline, thin and much compressed, the body of it elongated subrhomboid, with a nearly parallel dorsal and ventral lines when freed from the wing, bearing a greatly elevated, somewhat triangular posterior dorsal wing and a small anterior one, whose dorsal line is parallel with that of the base; beaks low and compressed, with scarcely any sculpture; posterior ridge low, double or treble, ending behind in a blunt, somewhat rounded point about at the median line; surface dull, greenish-yellow or brown, with faint rays

which often fade out at the border of the shell; the wing in fine specimens having a broad, faint, darker ray, whose base lies along the dorsal line; epidermis thin, cloth-like; left valve with an elongate pseudocardinal, sometimes there are vestiges of others, and two straight, delicate laterals; right valve with two lamellar pseudocardinals and one lateral; beak cavities very shallow with a few pits; muscle scars scarcely discernable; nacre brilliant, shining with a metallic luster, yellowish or purplish. I have examined a number of shells and in a few there is a slight fullness near the posterior base not seen in others, and these may be females.

Length 58, height, with wing, 45, without the wing 26, diam. 10 mm.

Guatemala; Monte Cristo, Tabasco, Mexico.

Unio delphinulus MORELET, Test. Noviss., I, 1849, p. 31.—HANLEY, Biv. Shells, 1856, p. 381, pl. XXIII, fig. 60.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLIII, fig. 237.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 557, pl. LXIII, figs. 2, 2*a*, 2*b*.

Margaron (Unio) delphinulus LEA, Syn., 1870, p. 28.

Lampsilis delphinulus SIMPSON, Syn., 1900, p. 576.

A striking and delicate shell. The front line of the great dorsal wing rises at an angle of about 60°; its posterior line forms a perfect ogee from the summit to the posterior point.

LAMPSILIS LARGILLIERTI (Philippi).

Yucatan.

Unio largillierti PHILLIPPI, Zeits. für Mal., IV, 1847, p. 94.—VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 521.

Lampsilis largillierti SIMPSON, Syn., 1900, p. 577.

Unfigured and unknown to me. From the description, which is not accessible to me at the present time, I should think that it probably belonged here. von Martens, (l. c.), suggests that it may be the same as *paludosa* Morelet.

SPECIES INCERTÆ SEDIS.

LAMPSILIS MOCTEZUMENSIS Pilsbry.

"The shell is oblong, the dorsal and ventral margins both arched, the former a little more so: altitude decidedly more than half the length, diameter more than one-third the length; moderately strong, but not thick. The beaks are small and low, near the anterior fourth of the length. In young shells they show one or two low, short undulations, being nearly smooth. Color yellowish-brown. Adult shells hardly showing rays, even by transmitted light, but the young have narrow green rays posteriorly, on a yellow ground, marked with dark concentric streaks. Both ends are rounded. Sculpture of growth-wrinkles only, weak on the middle of the valve, but rather emphatic anteriorly. The interior is white, the nacre thinner and iridescent posteriorly. The pseudocardinal teeth are moderately stout, blunt and nearly smooth. In the left valve the posterior cardinal is larger than the anterior. In the right valve the single cardinal is small. The lateral teeth are short and widely separated from the cardinals. The cavity of the beaks are rather deep.

Length 68, height 38.5, diam. 24 mm." (Pilsbry.)

Type locality, Moctezuma River, State of San Luis Potosi, Mexico.

Lampsilis moctezumensis PILSBRY, Pr. Ac. N. Sci. Phila., 1909, p. 534, pl. XXV, figs. 1, 2, 3, 4.

"This species has some resemblance to *spatulatus* (Lea). It differs from the related species by wanting corrugations on the posterior slope."

LAMPSILIS NOVILEONIS Pilsbry.

"The shell is oblong, rather compressed, the upper and basal margins slightly and about equally arcuate, anterior end rounded, posterior end sloping above, truncate and somewhat biangular below, beaks at the anterior two-sevenths of the length. The surface is convex, without angle or ridge bounding the posterior slope, not very glossy, smoothish for the greater part,

but on the posterior slope there is some oblique corrugation in the upper part of the disk. The epidermis is yellow, sparsely marked in the posterior half with narrow green rays. The very low beaks are eroded in the type specimen. The interior is white, thicker anteriorly, very gradually becoming thinner at the posterior end, where opalescent tints are beautifully produced. The cavity of the beak is rather deep. The lateral teeth are short and rather widely separated from the stout cardinals, which are double and about equally prominent in the left valve.

Length 78, height 43.5, diam. 22.5 mm." (Pilsbry.)

Type locality, Casas Viejas River, State of San Luis Potosi, Mexico.

Lampsilis novileonis PILSBRY, Pr. Ac. N. Sci. Phila., 1909, p. 537, pl. XXVII, figs. 1, 2, 7.

"With some resemblance to *L. moctezumensis*, this species differs by the slight corrugation of the posterior slope and the more compressed form. Some young specimens, (fig. 7), from the type locality, which seem referable to this species, have the whole valves ornamented with wide, green rays. The beaks have a minute area sculptured with about four concentric wrinkles, which are very weakly bilobed. Outside of this sculptured portion the green rays are very distinct, as in allied species. A faint rib or green stripe radiates from the beak in the middle of the posterior slope, which is in part obliquely corrugated. These specimens measure from 17.5 to 36 mm. long."

LAMPSILIS COYENSIS Pilsbry.

"The shell is oblong, with beaks at the anterior fourth of its length; slightly wider posteriorly, the posterior end sloping above, biangular below; anterior end rounded; basal outline moderately curved, convex. There is a rather distinct angulation from the beak towards the posterior-basal angle, and the indistinct trace of a ridge to the posterior-median angle. The beaks are low, with minute, recurved tips sculptured with a few coarse, double-festooned wrinkles, the connection between the two curves almost interrupted. The sculptured portion is

not quite two mm. long. Subsequent growth is marked with growth-lines only, or with a very slight oblique corrugation in places on the posterior slope. The epidermis is smooth, but not glossy, and is shortly and finely lamellose towards the margins. Color, obscure greenish-yellow, indistinctly marked all over with green rays. Near the beaks the rays are very distinct on a light ground. By transmitted light it is light yellowish, very profusely marked with green rays. The interior is white and somewhat thick anteriorly, thin, blue and slightly iridescent in the posterior half. The teeth are moderately strong.

Length 36, height 21, diam. 13.5 mm." (Pilsbry.)

Type locality, Coy River, State of San Luis Potosi, Mexico.

Lampsilis coyensis PILSBRY, Pr. Ac. N. Sci. Phila., 1909, p. 538, pl. XXVII, figs. 3, 4.

"This may turn out to be a small, rayed variety of *L. novileonis*, yet specimens from 28 to 36 mm. long have every appearance of adult shells. The cardinal teeth in the left valve are stouter and their crests are more united than in *L. novileonis*. While *L. undivaga, coyensis* and *novileonis* are closely related species, they seem, with present material, to be distinct."

LAMPSILIS UNDIVAGA Pilsbry.

"The shell is oblong, the altitude about three-fifths of the length, diameter slightly over one-third the length; solid, dull blackish brown, without rays. The anterior end is rounded, posterior end more or less truncate below, sloping steeply above. Surface of the valves with sculpture of distinct growth-lines, and sometimes having a patch of very indistinct vertical corrugations near the posterior ridge on the most convex portion. There are also some fine oblique corrugations on the posterior-dorsal slope near the beaks, when not worn off. Beaks low, between the anterior fifth and sixth of the length; when perfect the tip is acute and sculptured with a series of short folds on the posterior ridge. The interior is fleshy-purplish, iridescent posteriorly; nacre in the anterior half is *very thick*, posteriorly thin. Cavity of the beaks deep and angular.

The pseudocardinal teeth are stout, otherwise formed as in *L. signata;* laterals curved.

Length 54, height 33, diam. 19 mm.

Length 54, height 30, diam. 18 mm.

Length 50, height 30, diam. 18 mm." (Pilsbry.)

Type locality, Valles River, two miles above Mecos, Mexico.

Lampsilis undivaga PILSBRY, Pr. Ac. N. Sci. Phila., 1909, p. 536, pl. XXVI, figs. 1, 2, 3, 4; XXVII, fig. 5.

"This species is closely related to *L. signata,* but the valves are thicker and heavier, the teeth are heavier, and the proportions differ. It is apparently related to *L. aztecorum* (Phil.), but that is described as thin, *valvulis satis tenuibus,*" whereas in *L. undivaga* the valves are quite heavy and strong for a *Lampsilis* of this size.

The nacre is nearly white in a few examples. It abruptly becomes thick, (thin?), in the posterior half of the shell. Young shells are conspicuously rayed with green.

One young shell from the Valles River at Valles, (pl. XXVII, fig. 5), seems to belong to this species, though I am not quite sure of the identity. It is 41 mm. long, yellowish, nearly covered with green rays, the nacre is pale purple, with a wide, darker purple margin posteriorly."

LAMPSILIS SIGNATA Pilsbry.

"The shell is oblong with subparallel dorsal and ventral borders, twice as long as wide, the diameter contained about three times in the length. The anterior border is rounded, posterior border truncate below, sloping and more or less convex from the truncation to the posterior end of the hinge. In some specimens the posterior truncation is indistinct or that extremity may be rounded. The beaks are low and situated near the anterior fourth of the shell's length. Adult shells are blackish, but by transmitted light numerous green rays may be seen, fading out toward the lower border; and when unworn the beaks show a pretty pattern of distinct green rays on a pinkish or creamy ground. The surface has but little gloss; the cuticle

is roughened by growth-lines, which near the edge and on the posterior slope often form cuticular laminæ; the middle part of the valves is smoother, but marked with one or more *small patches of short corrugations,* at right angles to the growth-lines, and near the beaks there are some acute, fine, radial wrinkles on the posterior-dorsal slope.

The beaks are sculptured with two radial series of short, concentric wrinkles separated by a slight depression. The valves are rather thick in the anterior half, becoming abruptly thinner posteriorly. The nacre is purple, fading in the cavity, or bluish-white, becoming purplish and iridescent posteriorly. The pseudocardinal teeth are stout, the anterior one in the left valve wedge-shaped, a rather broad rugose heel below it, the posterior one lying directly under the beak; lateral teeth double as usual. The right valve has a stout, rugose pseudocardinal with a fossa and then a very small, compressed laminar tooth above it; lateral tooth single.

Length 73, height 37, diam. 23 mm." (Pilsbry.)

Type locality, Valles River, about three miles below Valles, Mexico.

Lampsilis signata PILSBRY, Pr. Ac. N. Sci. Phila., 1909, p. 536, pl. XXV, figs. 5, 6; pl. XXVI, figs. 5, 6.

LAMPSILIS SEMIRASA Pilsbry.

"The shell is oblong-reniform, the ventral margin being a little concave in the middle or straight, the upper margin strongly arched; the posterior end is wider in female shells, scarcely so in males. The altitude is contained about 1¾ times in length, diameter about three times in the length. The surface is smoothish except for growth-lines, which are strongest near the lower margin and anterior end. Color various shades of brown, with rather indistinct darker or greenish rays, chiefly on the posterior half. The beaks are low, at the anterior fifth of the length. When perfect they have double-looped, concentric sculpture. Valves thin, lined with nacre, which is whitish in the cavity and anteriorly, but pink and very iridescent posteriorly, (sometimes suffused with pink throughout, darker

and purplish below the pallial line or sometimes silvery white throughout). Pseudocardinal teeth compressed, rather small; lateral teeth very short, about one-third the shell's length. Ligament short.

Length 47, height 26, diam. 15 mm." (Pilsbry.)

Type locality, Ganina River, three miles southwest of San Dieguito, Mexico. Also in the Valles River at and above Mecos, Mexico.

Lamplisis semirasa PILSBRY, Pr. Ac. N. Sci. Phila., 1909, p. 534, pl. XXVI, figs. 7, 8, 9.

"Some specimens of the type lot are larger, length 55, height 28, diam. 16 mm. There is also some variation in the teeth, which may be more or less stout.

L. semirasa differs from *L. signata* and *L. undivaga* by lacking corrugation on the convexity of the valves and on the posterior-dorsal slope."

The following are unfigured and unknown:

Lampsilis fasciola RAFINESQUE, Ann. Gen. Sci. Brux., V, 1820, p. 299.

Lampsilis fulgens RAFINESQUE, Cont. Monog., 1831, p. 7.

Lampsilis argyratus RAFINESQUE, Cont. Monog., 1831, p. 7.

Genus FRIERSONIA Ortmann, 1912.

"Shell subelliptical, without distinct posterior ridge. Disk not sculptured. Beak-sculpture of the double-looped pattern, consisting of six to eight fine bars, of which the later ones are distinctly double-looped, and the latest are interrupted (unconnected) in the middle. Epidermis greenish-yellow, with rather distinct, simple rays. Male and female shells hardly different.

Inner lamina of inner gills connected with abdominal sac. Edge of mantle in front of branchial slightly laminate, with fine and distinct crenulations, disappearing gradually in front, but without papillæ. A brown streak of pigment along this part of the edge. Marsupium consisting of many ovisacs, occupying the larger posterior section of the outer gill. When

gravid, the ovisacs swell very little, and they are only slightly compressed in the basal part, which is largely enclosed between the laminæ of the gill. The ovisacs reach considerably beyond the edge of the gill, and in this region they are curved backward in a peculiar manner, subcylindrical, and tapering towards a point directed backward at the hind end of the marsupium. The marsupium has also a remarkably sharp edge. Placentæ not very solid. Glochidia lying all through the placental mass, of medium size, and subovate in shape." (Ortmann.)

Type *Lampsilis iridella* P. and F.

Friersonia Ortmann, Ann. Car. Mus., VIII, 1912, p. 318.

Friersonia iridella (Pilsbry and Frierson).

"The shell is oblong, wider posteriorly, with the beaks at the anterior two-ninths of the length, anterior end rounded; posterior part sloping above, subtruncate at the end, compressed below the hinge. Surface glossy, smoothish, obliquely corrugated along the posterior slope, (but sometimes very indistinctly so), and usually having a group of short, impressed lines or furrows vertical to the basal margin, near the middle of the disk. Of a dull straw or pale greenish color, profusely marked with green rays, which are usually quite distinct and narrow. The valves are thin, nacre bluish-silvery, very iridescent posteriorly. Cardinal teeth small, a single rather stout one in the right valve, two more compressed and generally subequal teeth in the left valve. Lateral teeth very narrow, double in the left, single in the right valve.

Length 49, height 26, diam. 15 mm." (P. & F.)

Type locality, Valles, Mexico.

L. iridella, Naut., XXI, 1907, pl. xii, two lower right-hand figs.

Lampsilis iridella Pilsbry and Frierson, Naut., XXII, 1908, p. 81.

Friersonia iridella Ortmann, Ann. Car. Mus., VIII, 1912, p. 319, fig. 19.

This species "is related to *U. popei* and *U. medellinus.*"

Genus PSEUDOSPATHA Simpson, 1900.

Spatha Smith, Pr. Zool. Soc. Lond., 1880, p. 350.
Burtonia Bourguignat, Moll. Fluv. Nyanza, 1883, p. 20.
Pseudospatha Simpson, Syn., 1900, p. 577.—Germain, Arch. Zool. Exp. et Gen. (5), I, 1909, p. 46.

Shell compressed, thin, oblique, inequilateral, with a straight dorsal line, which ends in a small wing in front and behind, rounded and cut away at the anterior base, produced in the post-basal region, gaping in front and behind, slightly twisted on its axis and usually bent posteriorly to the right or left; a low, often double posterior ridge ends in a biangulate point behind; beaks compressed, the sculpture faint, irregular, concentric ridges, which continue over the shell, and at the beaks sometimes become rather sharply pustulous, the glochidium often remaining; epidermis yellowish-brown, sometimes delicately rayed; teeth rudimentary, one or more faint, compressed pseudocardinals and a single lateral in each valve; muscle scars irregular; nacre coppery or purple, often rayed. Animal unknown.

Type, *Spatha tanganyicensis* Smith.

The shells of this group bear a striking resemblance to that of *Lampsilis leptodon,* in form, texture, color, teeth and in gaping in front and behind. While I know nothing whatever of the anatomy, I feel positive that the species do not belong to the *Multilidæ,* for such vestigial teeth as they possess are distinctly schizodont and not at all taxodont. The beak sculpture, though sometimes nodulous, shows more or less plainly concentric ridges, and this would indicate that the genus belonged to the *Exolvanchiæ.* I believe that it is rather closely related to *Chamberlainia, Pilsbryoconcha* and *Cristaria,* and the fact that all its species are found in Tropical Africa does not seem to me to be any evidence against this, for the genera *Nodularia* and *Parreysia* are distributed over the two areas and the *Anodonta guillaini* of Recluz, which is found in the Somali country in Africa, appears to be most nearly related to forms of southeastern Asia, so that I have placed it in the genus *Lamellidens.*

While none of these Oriental forms are very distinctly dimorphic as to shell characters, it may be remarked that in many species of the subgenus *Proptera* of *Lampsilis* the male and female shells are hardly distinguishable.

Germain, (l. c.), however, refers the genus to the *Mutelidæ*.

PSEUDOSPATHA TANGANYICENSIS (Smith).

Shell irregularly rhomboid, thin to subsolid, compressed, gaping widely in front, on the anterior half of the base, and slightly behind, with a low, double posterior ridge; a well-produced right angled anterior wing and a low, posterior one; narrowed in front and rounded on the anterior base, the outline full behind the center of the base, ending in a rounded or somewhat biangular point on the median line; truncated on the posterior slope; beaks low, compressed, sculpture consisting of concentric ridges developed into rows of rather sharp pustules and showing the round, nepionic shell; surface with irregular growth lines, copper-colored, sometimes rayed with green on the posterior half of the shell; left valve with a single uneven, low, somewhat lamellar pseudocardinal and one or two, more or less perfect, long laterals; right valve with a single pseudocardinal and one or two faint laterals; muscle scars shallow, with a couple of large scars placed at some distance from the hinge line and well behind the beaks; anterior scars irregular, impressed; posterior scars faint; nacre purplish, soft and iridescent.

Length 95, height 44, diam. 17 mm.

Lakes Tanganyika and Nyanza, Africa.

Spatha tanganyicensis SMITH, Proc. Zool. Soc. Lond., 1880, p. 350, pl. XXXI, fig. 8.

Burtonia tanganyicensis PÆTEL, Conch. Sam., III, 1890, p. 187.

Pseudospatha tanganyicensis SIMPSON, Syn., 1900, p. 577.—GERMAIN, Moll. L. Tan., 1908, p. 684.—Arch. Zool. Exp. et Gen., (5), I, 1909, p. 47, figs. 42, 43.

Burtonia moineti BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 33; Icon. Mal. Tan., 1888, pl. XXV, fig. 1.

Burtonia lavigerina BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 36; Icon. Mal. Tan., 1888, pl. XXIV, figs. 1-4.

Burtonia magnipica BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 41; Icon. Mal. Tan., 1888, pl. XXVI, figs. 1-2.

Burtonia jouberti BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 40. —GERMAIN, Moll. L. Tan., 1908, p. 685, figs. 37, 38.—SIMPSON, Syn., 1900, p. 578.

Burtonia foai MABILLE, Bull. Soc. Philom., III, 1901, p. 58.—GERMAIN, Moll. L. Tan., 1908, p. 685, figs. 39, 40.

The line between the valves is not exactly straight, and sometimes the posterior point is turned first to one side and then to the other. I am inclined to believe that the shells of this species are dimorphic and that Bourguignat's *Burtonia moineti*, in which the posterior base is not inflated, is the male of this species, though it is possible that it may be distinct. The posterior slope shows slight traces of plication.

PSEUDOSPATHA CARREI (Putzeys).

Shell elongated, inequilateral, compressed, with a nearly straight dorsal line; anterior end rounded, meeting the dorsal line at an obtuse angle; posterior end truncate above the base line, sweeping around from this truncation to the upper anterior point in a long curve; beaks minute, slightly elevated above the dorsal line; posterior ridge low but apparently well marked, ending behind in a rounded point on the median line; surface slightly concentrically rugose; epidermis fuscous-olivaceous, green at the umbonal region; nacre bluish, pearly and iridescent.

Length 72, height 24, diam. 12.5 mm.

Stanley Pool, Leopoldville, Congo.

Burtonia carrei PUTZEYS, Proc. Verb. Soc. Mal. Belg., 1898, p. XXVIII, fig. 16.

Mutelina carrei GERMAIN, Arch. Zool. Exp. et Gen., (5), I, 1909, p. 58.

Pseudospatha leopoldvillensis SIMPSON, Syn., 1900, p. 577.

At the time of publishing the Synopsis I had not been able to see the paper containing this species and the name was given erroneously in my work. The shell is something like *P. livingstonensis,* but the beaks are not placed nearly so close to the anterior end as in that species.

PSEUDOSPATHA LIVINGSTONENSIS (Bourguignat).

Shell thin, compressed, elongated, when young, narrow behind and drawn out into a long beak; when old the dorsal and basal lines are nearly parallel and the shell is rhomboid; posterior ridge double; there is a posterior and anterior wing, below the latter the shell is slopingly truncate; surface pale coppery, slightly concentrically ridged; beaks low, compressed, with concentric sculpture, which becomes nodulous near the embryo, showing the nepionic shell; there is one pseudocardinal and one lateral in each valve; beak cavities shallow, with an irregular dorsal scar well behind the pseudocardinals; adductor scars shallow; nacre purplish, somewhat iridescent behind.

Length 115, height 45, diam. 15 mm.

Lake Tanganyika.

Spatha tanganyicensis SMITH (part), Proc. Zool. Soc. Lond., 1880, pl. XXXI, fig. 8*a*; 1881, p. 296, pl. XXXIV, fig. 32.

Burtonia livingstonensis BOURGUIGNAT, Moll. Fluv. Nyanz., 1883, p. 20.

Pseudospatha livingstonensis SIMPSON, Syn., 1900, p. 578.

Pseudospatha livingstoni GERMAIN, Moll. L. Tan., 1908, p. 686.

Burtonia elongata BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 34; Icon. Mal. Tan., 1888, pl. XXV, fig. 3.

Burtonia contorta BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 39; Icon. Mal. Tan., 1888, pl. XXVI, figs. 3-5.

Burtonia bridouxi BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 40.—SIMPSON, Syn., 1900, p. 578.—GERMAIN, Moll. L. Tan., 1908, p. 687, figs. 41, 42.

The shell gapes considerably at the front and anterior base and slightly behind. The line of juncture between the valves

is not entirely straight. Bourguignat's *Burtonia contorta* is probably a specimen of this species which was injured and is on that account narrowed anteriorly. Until the shell has made a considerable growth its outline is exactly that of a *livingstonensis* of the same age.

PSEUDOSPATHA SUBTRIANGULARIS (Bourguignat).

Shell trapezoidal, compressed, with a small projecting anterior and a rather high post-dorsal wing; the dorsal line nearly straight; the posterior end obliquely truncate, with a low, double posterior ridge; surface with irregular, concentric growth lines, beautiful yellowish-chestnut, and faintly rayed before and behind; pseudocardinals wanting; laterals thick.

Length 102, height 49, diam. 18 mm.

Lake Tanganyika.

Burtonia subtriangularis BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 35; Icon. Mal. Tan., 1888, pl. XXV, fig. 2.

Pseudospatha subtriangularis SIMPSON, Syn., 1900, p. 578.

Burtonia grandidieriana BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 42; Icon. Mal. Tan., 1888, pl. XXVII, figs. 1-3.

PSEUDOSPATHA BOURGUIGNATI (Bourguignat).

Shell irregularly elliptical or obovate, subsolid, compressed, with a small, projecting anterior and a moderate posterior wing; dorsal line considerably highest at the middle, from which point it slopes in a straight line forward and back; outline from the anterior point around the base to the posterior point nearly evenly curved, a little fuller behind the middle; beaks compressed; surface splendid reddish-chestnut, the upper part of the umbonal region violaceous, interior violet and magnificently iridescent; pseudocardinals wanting; laterals solid.

Length 81, height 42, diam. 20 mm.

Lake Tanganyika.

Burtonia bourguignati BOURGUIGNAT, Un. and Ir. Tan., 1886, p. 38; Icon. Mal. Tan., 1888, pl. XXVII, figs. 4-5.

Pseudospatha bourguignati SIMPSON, Syn., 1900, p. 578.

Genus HYRIOPSIS Conrad, 1853.

Hyriopsis Conrad, Pr. Ac. N. Sci. Phila., 1853, p. 269.

Shell large, compressed, rhomboid-elliptical, dorsally winged and generally biangulate behind, sometimes produced in the post-basal region; beaks low, mostly compressed, the sculpture consisting of numerous concentric ridges, which are nearly parallel with the growth lines, generally extending well on to the disk of the shell, the earlier ones fine, often slightly nodulous or doubly looped; epidermis olive to brown, sometimes faintly rayed; pseudocardinals two or three in the left valve, one to three in the right, when young compressed, but often breaking into irregular denticles when old; laterals long, compressed, two in the left valve and one in the right, sometimes vertically striate, the left valve often having a sort of raised lamellar tooth at or just behind the beak. Beak cavities shallow; dorsal scars numerous, extending from the cavity downward and forward. Anterior muscle scars three, distinct, posterior large, indistinct; front end of the shell usually thickened; a row of plications often occurring just below the laterals, as in *Cristaria*.

Animal unknown.

Type, *Unio delphinus* Gruner.

Group of *Hyriopsis bialata*.

Shell somewhat trapezoidal, with a posterior ridge, biangulate behind, with a very high, pointed, triangular, posterior wing, and a smaller, pointed one in front, which projects forward; beaks low, sculpture not seen; epidermis brown; pseudocardinals broken up into denticles; hinge line slightly curved; the three anterior muscle scars separate and deep; dorsal scars not extending greatly downward in front; nacre bluish-white.

Hyriopsis bialata Simpson.

Shell elongated, subrhomboid, with a high, triangular posterior wing and a smaller anterior one, these wings are generally broken off when the shell becomes old; subsolid, rather compressed; posterior ridge high, angular, with a faint sec-

ondary ridge at some distance above it, the main ridge ends in a sharp point at the extreme post-basal part of the shell, the secondary ridge ends in an obtuse angle above it; ligament concealed in young shells, long and exposed in old ones; beaks low, their sculpture not known; epidermis black and somewhat shining, covered with scattered, low, pustule-like blisters, which are often arranged in concentric rows; left valve with a long, low, pinched up anterior pseudocardinal and a feeble posterior one, with two long, curved laterals; right valve with a long, irregular pseudocardinal, a small one above it and one lateral, all the pseudocardinals showing a tendency to break into denticles; beak cavities shallow, with an irregular row of pits; anterior muscle scars distinct, well impressed, small; nacre bluish-white with a slight pallial sinus.

Length 135, height, without the wing, 56, height with the wing 80, diam. 25 mm.

Southeastern Asia, including Cambodia, Siam, and the Malay Peninsula.

Unio delphinus GRUNER, Arch. für Naturg., I, 1841, p. 276, pl. IX, figs. 1, 1*a-c*.—DELESSERT, Rec. Coq. Lam., 1841, pl. XIX, figs. 3, 3*a*, 3*b*.—LEA, Tr. Am. Phil. Soc., VIII, 1843, p. 218, pl. XVII, fig. 35; Obs., III, 1842, p. 56, pl. XVII, fig. 35.—KUSTER, Conch. Cab. Unio, 1852, p. 18, pl. II, figs. 2-4.—HANLEY, Biv. Shells, 1856, p. 381, pl. XX, fig. 44.—CHENU, Man., 1859, II, p. 143, fig. 707.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLIII, fig. 238.

Margaron (Unio) delphinus LEA, Syn. 1852, p. 19; 1870, p. 28.

Metaptera delphinus MORLET, J. de Conch., XXXVII, 1889, p. 165.

Unio megapterus MORELET, J. de Conch., XII, 1863, p. 159.

Hyriopsis bialatus SIMPSON, Syn., 1900, p. 579.

Unio delphinopterus DAUTZENBERG and FISCHER, J. de Conch., LIII, 1905, p. 456.

A most striking species, having when young and perfect a very high wing. Gruner's name was used previously by Spengler for a *Unio* and the term *megapterus* of Morelet was applied by Rafinesque to a *Metaptera (Unio)* and used by Chenu under the generic name *Unio* before 1863.

The scattered pustules, like blisters, is a peculiar feature.

HYRIOPSIS GRACILIS (Haas).

"Shell long, narrow, alate, rather solid. Anterior end very short; the superior margin somewhat curved in front and drawn out in a horizontal or bent up point, meeting the anterior margin at a distinctly sharp angle; anterior margin concave above, slightly convex below as it passes into the almost horizontal, slightly convex basal margin; posterior end rounded and slightly biangulated; posterior margin oblique; wing nearly one-half the height of the shell, concave behind, rounded at the end and nearly straight in front, meeting the dorsal margin at an angle of 45° a short distance behind the beaks. Beaks anterior, placed at 19/100 of the total length, not projecting nor swollen, sculptured with a few, concentric, wavy wrinkles. From the beaks to the biangulations of the posterior end extend two feeble, thread-like lines, which become lower posteriorly. Ligament strong, covered by the wing. Cardinal teeth weak; two in the right valve, the inner one lower and lamelliform, the outer one subobsolete, lamelliform; in the left valve a rather stouter, lamelliform tooth, in front of two feeble ridge-like teeth; lateral teeth long, straight, two in the left and one in the right valve. Angle of the cardinal teeth 40°; angle of the lateral teeth 0°. Nacre bluish-white. Muscle impressions weak. Epidermis black-brown or brown-green, eroded on the beaks.

Length 110, greatest height 68, height at the beaks 39, height of the wing 27, diam. 19 mm." (Haas.)

Type locality, Bienho-Sei, Mekong.

Hyriopsis gracilis HAAS, Nachr. Deutsch. Mal. Ges., 1910, p. 101.

Group of *Hyriopsis cumingii*.

Shell rather thin, with a high wing posteriorly and a smaller one in front; beaks greatly compressed, their sculpture at first consisting of fine and later of coarse concentric ridges, which extend well on to the disk; corrugations on the posterior slope distinct.

HYRIOPSIS CUMINGII (Lea).

Shell large, rhomboid or trapezoid, with a sharp pointed anterior wing and a very high, somewhat irregular posterior wing; rather thin or only subsolid; compressed, with low, much compressed beaks, which are sculptured with numerous strong ridges that nearly follow the growth lines and extend well out on to the disk; surface shining, the posterior wing and hinder part of the shell sometimes corrugated by irregular grooves; folds of the posterior slope distinct; color brownish or yellowish-green with numerous rays; epidermis shining; left valve with two small, compressed, rather elevated and nearly vertical pseudocardinals, the anterior higher, and two long, curved laterals; right valve with two pseudocardinals, the posterior higher, and one lateral; beak cavities very shallow, showing a diagonal row of scars; adductor scars shallow, the anterior ones small; pallial line very far removed from the shell border; nacre bluish-white, with purple and green iridescence behind.

Length 134, height, without wing 80, with wing 117, diam. 18 mm.

China.

Unio cumingii LEA, Pr. Ac. N. Sci. Phila., VII, 1852, p. 54.—Jl. Ac. N. Sci. Phila., IV, 1860, p. 240, pl. XXXV, fig. 120; Obs., VII, 1860, p. 58, pl. XXXV, fig. 120.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLIX, fig. 264.—HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LXIV.

Margaron (Unio) cumingii LEA, Syn., 1852, p. 19; 1870, p. 28.

Hyriopsis cumingii SIMPSON, Syn., 1900, p. 579.

Hyriopsis goliath ROLLE, Nachr. Deutsch. Mal. Ges., 1904, p. 25, pl. I and II.—DAUTZENBERG and FISCHER, J. de Conch., LIII, 1905, p. 201.

Lea's larger shell, the one whose dimensions are given above, is evidently young and probably a female, as it is slightly swollen at the post-basal part. He has a somewhat younger shell which is straight on the basal line.

HYRIOPSIS DELAPORTEI (Crosse and Fischer).

Shell with a high, irregular posterior wing, which is often curled over at the top, and a smaller anterior wing like that of a *Prisodon*, the median dorsal line nearly straight, showing a part of the ligament, somewhat triangular, subsolid, scarcely inflated, with a rather high, sharp or angled posterior ridge; beaks compressed, their sculpture consisting of 7 or 8 bars running parallel with the hinge line; epidermis pale, yellowish-green or greenish-brown, scarcely shining; left valve, when young, with two long, compressed pseudocardinals and two curved laterals; right valve with two pseudocardinals and one lateral; in some of the young there are three pseudocardinals in each valve. As the shell grows older these break up into vertical ridges and the laterals are shortened and become remote; beak cavities shallow with an irregular row of pits; anterior scars impressed; posterior scars faint; nacre bluish-white, often blotched and dull.

Length 130, height, without wing 70, with wing 100, diam. 35 mm.

Cambodia, Siam.

Unio (Arconaia) delaportei CROSSE and FISCHER, J. de Conch., XXIV, 1876, p. 327, pl. X, fig. 1; pl. XI, fig. 5.

Arconaia delaportei MORLET, J. de Conch., XXXVII, 1889, p. 165.

Hyriopsis delaportei SIMPSON, Syn., 1900, p. 580.

The line of junction between the valves is not straight but somewhat flexuous and the anterior or posterior end of the shell may be flexed a little to the right or left, hence Crosse and Fischer placed the species in *Arconaia*. There is a slight anterior and posterior gap to the shells as in so many of the winged American forms, and the shells seem to be somewhat dimorphic. In two of the U. S. Nat. Museum specimens there is quite a post-basal inflation and the posterior point is elevated above the base line. In another the base line is a little incurved medially and the posterior point is not at all raised. There are traces of plication on the post-dorsal region in most shells and the escutcheon is very large.

Group of *Hyriopsis myersiana.*

Shell rather solid, thickened in front; posterior ridge rather low; beaks compressed, the sculpture consisting, apparently, of a few rather faint, irregular ridges, sometimes slightly nodulous.

HYRIOPSIS MYERSIANA (Lea).

Shell large, elliptical or obovate, subcompressed or compressed, solid when old, with a small anterior wing and a high, ragged posterior wing when young, which is lost in old age; posterior ridge well developed, sometimes angulated, and there are often one or two faint ridges on the posterior slope; beaks low, raised a little above the hinge line, subcompressed, with faint, horizontal ridges, occasionally slightly nodulous; left valve with two or three compressed, elongated, somewhat uneven pseudocardinals and two curved laterals; right valve with two pseudocardinals, the lower higher, and one lateral; when the shell becomes old the laterals are remote and the pseudocardinals become split across into numerous irregular denticles; beak cavities shallow; muscle scars of the cavities in a diagonal row; anterior adductor scars small, impressed; posterior scars shallow; nacre white or flesh-colored, often iridescent. The shells generally end in a wide, faint biangulation behind; in some of these the biangulation is mostly below the median line, and the post-basal line is not much extended; in others the point is midway up the shell and there seems to be a marsupial swelling.

Length 165, height 95, diam. 45 mm.

Siam; Cambodia.

Unio myersianus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 92; Jl. Ac. N. Sci. Phila., III, 1857, p. 290, pl. XXII, fig. 2; Obs., VI, 1857, p. 10, pl. XXII, fig. 2.—SOWERBY, Conch. Icon., XVI, 1866, pl. L, fig. 265.

Margaron (Unio) myersianus LEA, Syn., 1870, p. 28.

Metaptera myersianus MORLET, J. de Conch., XXXVII, 1889, p. 165.

Hyriopsis myersianus SIMPSON, Syn., 1900, p. 580.

Unio housei LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 92; Jl. Ac. N. Sci. Phila., III, 1858, p. 291, pl. XXIII, fig. 3; Obs., VI, 1857, p. 11, pl. XXIII, fig. 3.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLVIII, fig. 260.

Margaron (Unio) housei LEA, Syn., 1870, p. 28.

The epidermis is olive-green when young and brown in the adult shell; in old specimens the nacre is very thick anteriorly. A single old valve in the Lea collection is 185 millimeters in length, and its pseudocardinals are heavy and consist of strong, irregular cross ridges; the laterals are short and remote. *Unio housei* of Lea is, I am sure, only the young of the above. There are scarcely any traces of plications on the posterior slope.

HYRIOPSIS SUTRANGENSIS (Morlet).

Shell large, obovate and subrhomboid, thick, subinflated, with a blackish epidermis, which is concentrically striated and lamellate behind; hinge and basal line slightly curved; behind the hinge the shell is angled, and below this it is obliquely truncated and sinuous; anterior end rounded and narrowed; posterior ridge low; beaks well forward, their sculpture not observed; right valve with two rather short, thick, crenulate pseudocardinals and one long, thin lateral; left valve with one pseudocardinal and two laterals; anterior muscle scars deep, with two well-marked, smaller scars at each; posterior scars shallow; dorsal scars five or six; nacre whitish, bluish behind.

Length 140, height 62, diam. 34 mm.

Sutrang River, Siam.

Unio sutrangensis MORLET, J. de Conch., XXXVII, 1889, p. 195, pl. IX, fig. 3.

Hyriopsis sutrangensis SIMPSON, Syn., 1900, p. 580.

This species probably belongs in the genus *Hyriopsis*, though Morlet believes it to be near to *Unio scutum*. Nothing is known of its beak sculpture.

HYRIOPSIS FULVASTER (Drouet and Chaper).

Shell elliptic, subrhomboid, rather short, subinflated, thin, inequilateral; post-dorsal part somewhat elevated, and almost wing-like; anterior end somewhat narrowed, truncate above,

rounded below; base curved, a little fuller behind the middle: dorsal slope almost squarely truncated; lower posterior outline rounded; posterior ridge low, rounded; beaks scarcely elevated; hinge line somewhat curved; teeth compressed; laterals prominent behind; nacre pale bluish, rose-tinted, with livid blotches in the cavities.

Length 38, height 28, diam. 15 mm.

Kapoeas, Borneo.

Unio fulvaster DROUET and CHAPER, Mem. Soc. Zool. Fr., V, 1892, p. 154, pl. VI, figs. 11-13.

Nodularia fulvaster SIMPSON, Syn., 1900, p. 819.

Contradens fulvaster HAAS, Conch. Cab., 1912, pl. 20, figs. 4-5.

Probably a young shell, and I cannot be sure as to its relationship. In the Synopsis I placed it in *Nodularia*, but I am now inclined to believe it may be an *Hyriopsis*. The authors state that the beaks of their shell are eroded and make no mention of any sculpture on the disks. The color seems to be a light brown.

HYRIOPSIS PINCHONIANA (Heude).

Shell subsolid, almost regularly elliptical, compressed, with a low, somewhat double posterior ridge; beaks slightly elevated, their sculpture not observed; dorsal region having vestiges of posterior wing; epidermis yellowish-brown with faint, green rays; pseudocardinals compressed, apparently one in the right valve and a feeble lamina above it; anterior muscle scars impressed; nacre pale salmon-color, somewhat iridescent.

Length 63, height 35, diam. 15 mm.

Tch'eng-tou fou, Province of Se-tchouan, China.

Unio pinchonianus HEUDE, Conch. Fluv. Nank., VIII, 1883, pl. LXIII, fig. 12.

Hyriopsis pinchonianus SIMPSON, Syn., 1900, p. 580.

The specimen figured by Heude is nearly evenly elliptical in outline, showing traces of bianguation behind, and having a curved base line. The figure shows ragged traces of a postdorsal wing.

Group of *Hyriopsis vagula.*

Shell elliptical, with a rather high, posterior wing, moderately solid, with two slight posterior ridges and a sulcus above them at the juncture of the wing.

HYRIOPSIS VAGULA (Fischer).

Shell irregularly elliptical or subrhomboid, subcompressed, solid, with a low, curved posterior ridge; beaks full and inflated for a member of this genus, their sculpture not seen; surface rich olive-brown; dorsal line nearly straight; outline of posterior slope truncated, ending in an obtuse angle at the summit of the wing; anterior end of the shell rounded; posterior end more narrowly rounded; base evenly curved; nacre whitish-salmon in the cavity of the shell.

Length 100, height over all 80 mm.

Siam.

Unio subtrigonus SOWERBY, Conch. Icon., XVI, 1867, pl. LVIII, fig. 292.

Margaron (Unio) subtrigonus LEA, Syn., 1870, p. 28.

Unio (Monocondylæa) cambojensis SOWERBY, Conch. Icon., XVI, errata.

Pseudodon cambojensis MORELET, Ser. Conch., IV, 1875, p. 336.

Unio lamellatus HANLEY and THEOBALD, Conch. Ind., 1876, p. 5, pl. IX, fig. 6.

Unio vagulus FISCHER, Bull. Soc. Autun., IV, 1891, p. 223.

Hyriopsis vagulus SIMPSON, Syn., 1900, p. 580.

The above description is taken from Sowerby's figure and description. Sowerby says nothing whatever of the teeth or muscle scars, and I cannot therefore be certain as to its systematic position, but believe with Fischer that it is near the *Unio myersianus* Lea. Sowerby published the species in the Conchologia as *Unio subtrigonus,* but the name was preoccupied by Deshayes. In the errata he changed it to *Unio (Monocondylæa) cambojensis,* believing it to equal Petit's species. It is certainly not that shell and I therefore accept Fischer's name for it.

Group of *Hyriopsis velthuizeni*.

Shell somewhat inflated, rather thin, rounded behind, winged; epidermis dark brown with numerous green rays; nacre iridescent, bluish-white; anterior scars irregular, rather small; posterior scars rounded; pseudocardinals elongated, one in each valve, in the right valve there being a secondary rudimental one; laterals elongate, arcuate, one in the right valve and two in the left.

HYRIOPSIS VELTHUIZENI (Schepman).

Shell subtriangular, thin, scarcely inflated, with a well-developed, rounded posterior ridge, which is slightly double and biangulate, the lower ridge the most distinct; with a high, thin, posterior wing, which is rather acutely angled behind and a small, obtusely angled anterior one; base line nearly straight, sometimes feebly incurved in the middle; surface finely, irregularly, concentrically striate, shining, yellowish-olive, faintly rayed; beaks low, sculpture not seen; left valve with one pseudocardinal and two nearly straight laterals; right valve with one pseudocardinal, a small one above it, and one lateral; teeth all lamellar; muscle scars feeble; nacre bluish, tinted purple, iridescent, especially on the wings.

Length 65, height 30, to summit of wing 53, diam. 20 mm. The above measurements are from what is probably a young shell.

Mandai River, Borneo.

Unio velthuizeni SCHEPMAN, Notes Leyden Mus., XVII, 1895, p. 160, pl. IV, figs. 1, 1*a*.

Hyriopsis velthuizeni SIMPSON, Syn., 1900, p. 581.

This shell suggests an extremely close relationship to such species as *Lampsilis alata* and its variety *poulsoni* or the *L. inflata*.

Group of *Hyriopsis schlegeli*.

Shell rather thin, slightly winged behind, narrowly rounded before and angled at umbonal slope; posterior ridge high and rounded; beaks rather low; epidermis rough, blackish; hinge

line curved in front, straight behind; pseudocardinals generally entire; plications below the laterals faint; nacre dull lurid purplish or lead-color.

HYRIOPSIS SCHLEGELI (von Martens).

Shell large, irregularly long-ovate, subsolid, rather compressed, slightly gaping before and behind, with a well-developed, somewhat biangular, posterior ridge; beaks low, apparently compressed, but very deeply eroded in all the specimens seen; there is a faint post-dorsal wing and from this the shell is obliquely truncate behind; epidermis showing concentric growth lines, very thick and black, having a tendency to crack off; left valve with two low, radial pseudocardinals; the right valve has one and they show a tendency to split up into radial denticles; there are two remote straight laterals in the right valve and one high truncated one in the right; beak cavities shallow, with a row of pits pointing towards the anterior end of the shell; muscle scars well impressed, the anterior ones distinct; pallial line deep in front; nacre dirty lurid whitish, generally with large, darker blotches, much thicker for a short distance in front. The limited amount of material I have seen does not justify me in saying that the shells of this species are dimorphic.

Length 200, height 100, diam. 50 mm.

Japan.

Unio schlegeli VON MARTENS, Mal. Blatt., VII, 1861, p. 55.—KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 421, pl. XIV.—VON MARTENS, Nov. Conch., V, 1879, p. 192, pl. CLVIII, figs. 4, 5.

Barbala schlegeli PÆTEL, Conch. Sam., III, 1890, p. 175.

Hyriopsis schlegeli SIMPSON, Syn., 1900, p. 581.

A very large, elongated, compressed and rather unattractive species, which is not very closely related to any other known form. There are traces of plications on the posterior slope.

Subgenus CAUDICULATUS Simpson, 1900.

Caudiculatus SIMPSON, Syn., 1900, p. 581.

Shell oval, inflated, slightly posteriorly winged, with a well-developed posterior ridge and above it a deep, wide furrow ending in a broad, well-defined notch on the posterior slope; one pseudocardinal in the right valve and two in the left; two laterals in the left valve and one in the right. Animal unknown.

Type, *Unio caudiculatus* von Martens.

HYRIOPSIS CAUDICULATA (von Martens).

Shell oval, much inflated, very inequilateral, rather smooth, with only slight wrinkles and numerous fine, concentric striæ; beaks prominent, decorticated in the specimens examined; epidermis dark brown with a metallic luster, somewhat velvety near the extremities; upper margin slightly curved posteriorly, straight anteriorly; anterior margin rounded, passing insensibly into the convex ventral margin; posterior margin oblique above, with an obtuse angle near the superior one; somewhat below the middle of its length it is deeply and widely emarginate; posterior end widely truncated; from the edges of this truncation two low posterior ridges run towards the beaks; nacre blue, iridescent near the free margins, olive-yellow near the beaks; hinge strong; teeth irregular, thick; there is a crenulated pseudocardinal in the right valve and two nearly consolidated ones in the left; two nearly straight laterals in the left valve and one in the right; anterior scars irregular, deep; posterior scars shallow; pallial line distinct.

Length 67, height 47, diam. 29 mm.

Small brook near Singangi in the Ketoengau District, Borneo.

Unio caudiculatus VON MARTENS, Mal. Bl., XIV, 1866, p. 16.

Unio infrarostratus SCHEPMAN, Notes Leyd. Mus., XVII, 1895, p. 161, pl. IV, fig. 2.

Hyriopsis caudiculatus SIMPSON, Syn. 1900, p. 581.

Caudicalatus caudiculatus HAAS, Conch. Cab., 1912, pl. 18, fig. 1.

I have never seen this species and have considerable doubt as to its relationship. It is placed in *Hyriopsis* provisionally.

Genus CHAMBERLAINIA Simpson, 1900.

Chamberlainia Simpson, Syn., 1900, p. 582.

Shell large, very solid in front, thinner behind, round or round obovate, with low posterior ridge, alate on the post-dorsal part when young; beaks full, sculpture not seen; surface without sculpture excepting a few slightly pustulous corrugations on the posterior slope; epidermis dull, not rayed; hinge curved; pseudocardinals rather small, stumpy, two in the left valve and one in the right; laterals short, remote, the intervening hinge plate rounded, one lateral in the right valve and two in the left, the upper the smaller, and all curved upward along their inner edges; beak cavities not deep; dorsal muscle scars numerous, deep, extending from the cavity downward and forward; area outside the pallial line very wide; nacre lurid bronzy. Animal unknown.

Type, *Unio hainesianus* Lea.

Chamberlainia hainesiana (Lea).

Shell short obovate, solid, subcompressed, with moderately high, subcompressed beaks, from which a rounded posterior ridge runs out a short distance on to the disk and vanishes; there is a very small anterior and a moderate posterior wing, which is corrugately plicate; a slight radial sinus runs from the beaks to the posterior part of the shell just above the median lines; epidermis warm brown, rather dull; left valve with two small, erect pseudocardinals and two remote laterals, the upper the smaller, both having the inner edges reflexed; right valve probably having one pseudocardinal and one lateral; beak cavities moderately deep, with a row of scars under the pseudocardinals; anterior muscle scars rough, impressed; posterior scars shallow; nacre white and very thick at the anterior base, the rest lurid, somewhat iridescent behind; pallial line a long way from the border of the shell.

Length 203, height 150, diam. 78 mm.

Siam.

Unio hainesianus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 92; Jl. Ac. N. Sci. Phil., III, 1857, p. 289, pl. XXI, fig. 1; Obs., VI, 1857, p. 9, pl. XXI, fig. 1.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLVII, fig. 254.

Margaron (Unio) hainesianus LEA, Syn., 1870, p. 28.

Chamberlainia hainesiana SIMPSON, Syn., 1900, p. 582.

Unio imperialis MORELET, Rev. et Mag. Zool., XIV, 1862, p. 480.

The type consists of a single valve of a young individual. *U. imperialis*, according to its author, attains a size of 142 mm. in height, 192 mm. in length, and 77 mm. in diameter. I have seen a very fine specimen in the Frederick Stearns collection 6 inches high and 8 in length. It is one of the most magnificent Naiades in the world.

CHAMBERLAINIA PAVONINA Rochebrune.

"Shell thick, heavy, subtrigonal, inequilateral, slightly compressed, slightly gaping; olive-brown, subshining; deeply concentrically sulcate, sulci here and there subfoliaceous; dorsal margin oblique; anterior round, obtusely subrostrate; posterior abruptly truncate, subalate, faintly triangular; basal margin broadly convex; beaks eroded, subcontiguous, rounded, situated at about one-fifth of the length; disk flattened, with broad, undulating, slightly spreading plications; ligament heavy, short, curved, somewhat covered; interior whitish-blue, more or less pearly, deep coppery and iridescent posteriorly.

Length 175, height 134, diam. 65 mm." (Rochebrune.)

Type locality, Battambang, Province of Salabury, Siam.

Chamberlainia pavonina ROCHEBRUNE, Bull. Mus. Hist. Nat., 1904, p. 464.

"This form, while close to *Chamberlainia hainesiana*, differs by its less trapezoidal, more ovoid shape, by the more rounded anterior end, by the greater convexity of the basal margin, by the aliform expansion of the posterior margin being more triangular and less rounded, the more anterior beaks, which are less acute, by the pseudocardinals stronger, more massive proportionally and more deeply crenulate and finally by the longer and more prominent teeth."

CHAMBERLAINIA PAVIEI (Morlet).

Shell subtriangularly orbicular, inequilateral, very slightly convex, with faint, concentric striæ and a thin yellow-green epidermis; beaks pointed, decorticated in the shells examined; anterior end rounded below, angled at its junction with the dorsal line; dorsal wing rather high, angled behind; right valve with two solid pseudocardinals and one curved lateral, the hinge line being much narrowed and curved in front of it; nacre pale yellowish or whitish.

Length 67, height 65, diam. 25 mm.

Siam.

Unio paviei MORLET, J. de Conch., XXXIX, 1891, pl. VII, fig. 3.
Chamberlainia paviei SIMPSON, Syn., 1900, p. 582.
Chamberlainia pavici ROCHEBRUNE, Bull. Mus. Hist. Nat., 1904, p. 463.

Morlet does not give the number of the teeth in each valve, but those of the right valve are shown in his figure. The shell seems to be close to that of *C. hainesiana*, but is more triangular in outline.

Rochebrune, (l. c.) states that the series in the Museum d'Histoire Naturelle show that this species is the young of *C. hainesiana*.

Genus SIMPSONIA Rochebrune, 1904.

Simpsonia ROCHEBRUNE, Bull. Mus. Hist. Nat., 1904, p. 465.

"Shell elongate-ovoid; very thick, heavy, with a slight posterior wing; strongly sulcate; beaks thick, obtuse, subcontiguous, their cavity quite deep; ligament short, wide, subobtuse; pseudocardinals, two in the left valve, not large, compressed, separated by a broad, concave, six-dentate interval, one in the right valve, very large, quadrate, deeply bisulcate; laterals short, very heavy, one in the right valve, very wide, high, rounded above, two in the left valve, of equal length, very short, acute, in the form of a letter X; muscular impressions deep, rugosely sulcate; pallial line deep, very wide in front." (Rochebrune.)

Type, *Unio duclerci* Rochebrune.

SIMPSONIA DULCLERCI (Rochebrune).

Shell subrhomboid, somewhat lenticular, solid, scarcely inflated, sometimes subcompressed; posterior ridge low and very wide, slightly biangulate; beaks not high nor full, their sculpture not seen; surface with irregular growth lines; epidermis apparently olive-green; there is a low posterior wing, which is worn away in old shells; hinge line nearly evenly curved; left valve probably having two pseudocardinals and two laterals; right valve with one strong, triangular, high pseudocardinal, with a vestige of a small one in front of it, and one remote, short, truncated lateral, which is decidedly reflexed along its inner edge; the hinge line is smooth and rounded between the two teeth; beak cavities deep, with a row of pits under the pseudocardinal; muscle scars impressed, the anterior roughened; nacre whitish, clouded with purplish-brown, soft and shining, very thick in front; pallial line deep.

Length 122, height 90, diam. about 45 mm.

Mekong River, Siam.

Unio duclerci ROCHEBRUNE, Bull. Soc. Phil., VII, 1882, p. 27, pl. 1, fig. 2 (in extract).

Chamberlainia duclerci SIMPSON, Syn., 1900, p. 582.

Simpsonia duclerci ROCHEBRUNE, Bull. Mus. Hist. Nat., 1904, p. 465.

Two right valves much worn and eroded were donated to the National Museum by Mr. John B. Henderson, Jr. The short lateral is reflexed as it is in *Lepidodesma* and the nacre, which is peculiarly clouded, is very greatly thickened in front.

SIMPSONIA DEMANGEI Rochebrune.

"Shell very thick, compressed, elongate-ovate, inequilateral, gaping in front, with a slight posterior wing; laminately, concentrically sulcate, deeply eroded, dark blackish-brown, irregularly radiately costate, with broad, flat, interrupted folds; dorsal margin almost straight, slightly oblique, anterior margin small, rounded and somewhat produced; posterior margin subtriangular, subcompressed; basal margin the longest, almost straight, slightly undulated; beaks small, compressed,

subcontiguous, placed at about 1/7 of the length; area small; ligament very long, thick, very black; interior pearly, tinged with pale rose.

Length 240, height 169, diam. 75 mm." (Rochebrune.)

Type locality, Riviere Claire between Vietri and Tuyen-Quas, Tonkin.

Simpsonia demangei ROCHEBRUNE, Bull. Mus. Hist. Nat., 1904, p. 465.

Genus CRISTARIA Schumacher, 1817.

Barbala HUMPHREYS, Mus. Col., 1797.
Dipsas LEACH, Zool. Miscellany, I, 1815, p. 119.
Cristaria SCHUMACHER, Essai Nouv. Syst., 1817, p. 107.
Appius (LEACH), Menke. Syn., 2d ed., 1828, ? p. 106.
Symphynota LEA (part), Tr. Am. Phil. Soc., 1830, p. 445.
Dianisotis RAFINESQUE, Cont. Monog., 1831, p. 7.
Dipsax VOIGT, Cuvier, Thierreich, III, 1834, p. 493.
Barbata SOWERBY, Conch. Man., 1842, p. 81.
Clione GISTEL, Nat. Sur. Hoh. Schule Bearb., 1848.

Shell generally thin, elliptical, more or less winged posteriorly; beaks rather low, sculptured with fine, somewhat doubly-looped ridges at first, and later with coarse, low, concentric bars, which are nearly parallel with the growth lines; epidermis smooth, often somewhat rayed; hinge teeth imperfect; pseudocardinals feeble or wanting—when present consisting of a single compressed tooth in each valve; laterals single, remote, compressed, sometimes wanting in adult shells.

Type, *Dipsas plicatus* Leach.

Subgenus CRISTARIA s. s.

Shell large, thicker in front, strongly alate posteriorly, with two or more slightly developed radial ridges on the posterior slope and a row of plications above them; hinge line regularly curved; dorsal scars forming a row running obliquely downward and forward; anterior scars often blurred, posterior faint.

CRISTARIA PLICATA (Leach).

Shell very large, somewhat rhomboid, thin or subsolid, not inflated, with low, compressed beaks, whose sculpture consists of a few feeble ridges running nearly parallel with the growth lines and fading out at the posterior ridge; posterior ridge rather high and rounded in the earlier stages of growth, nearly obsolete below on older shells; there is a sharply angled, sometimes elevated wing in front and a high one with an irregular dorsal border behind; surface greenish-yellow to pale or brownish-olivaceous, faintly rayed in the young shells; posterior dorsal plications strong, showing inside and out and extending from the beaks to the hinder end of the laterals; post-dorsal region obliquely truncate, the outline straight in young shells, incurved in old ones; posterior end sometimes slightly biangulate; escutcheon large; each valve has a single short lateral; beak cavities shallow, with a row of scars pointing towards the anterior base; muscle scars shallow, the anterior irregular; nacre dull whitish, often blotched, thicker in front in old shells.

Length 230, height including wing 176, without wing 142, diam. 60 mm.

China; Japan; Amurland, south probably to Cambodia.

Dipsas plicatus LEACH, Zool. Miscellany, I, 1815, p. 120, pl. LIII.—SOWERBY, Conch. Man., 1839, fig. 142.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 15, pl. VI, fig. 1.—HEUDE, Conch. Fluv. Nank., 1879, pls. XXXIII, XXXIV, LI, fig. 94.

Mytilus plicatus SOLANDER, in Gray, Ann. of Phil., IX, 1825, p. 27.

Appius plicatus GRAY, in Menke, Syn. Meth. Moll., 1830, p. 106.

Margarita (Dipsas) plicatus LEA, Syn., 1836, p. 47; 1838, p. 28.

Margaron (Dipsas) plicatus LEA, Syn., 1852, p. 46; 1870, p. 74.

Unio plicatus SOWERBY, Conch. Icon., XVII, 1868, pl. LIV, fig. 280.

Dipsas plicata KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 429, pls. XV-XVII, XVIII, fig. 1.

Barbala plicata H. and A. Adams, Gen. Rec. Moll., II, 1857, p. 501, pl. cxvii, figs. 4, 4*a*.

Anodonta plicata Schrenck, Reis. und F. Am. Lande, II, 1867, p. 704, pl. xxvii, fig. 4.

Anodonta (Dipsas) plicata Clessin, Conch. Cab. Anodonta, 1876, p. 240, pl. xxi, figs. 1, 2.

Cristaria plicata von Ihering, Abh. Senck. Nat. Ges., XVIII, 1893, p. 147.—Simpson, Syn., 1900, p. 583.

Cristaria tuberculata Schumacher, Ess. Nov. Syst., 1817, p. 140, pl. xx, fig. 2.

Anodonta dipsas Blainville, Man. Mal., 1825, p. 538, pl. lxvi, fig. 2.

Symphynota bialata Lea, Tr. Am. Phil. Soc., 1830, p. 445, pl. xiv, fig. 24; Obs., I, 1834, p. 59, pl. xiv, fig. 24.

Unio bialata Hanley, Biv. Shells, 1843, p. 214, pl. xxii, fig. 4.

Barbala bialata Chenu, Man., 1859, p. 145, fig. 717.

Unio bialatus Deshayes, Tr. Elem. Conch., 1839, p. 19, pl. xxxi, fig. 3; Tr. Elem., II, 1853, p. 218, pl. xxxi, fig. 3.—Sowerby, Conch. Icon., XVI, 1868, pl. xlvi, fig. 247.

Anodonta magnifica Clessin, Conch. Cab. Anodonta, 1873, p. 123, pl. xxxv, fig. 1.

Barbala plicatula Pætel, Conch. Sam., III, 1890, p. 175.

I cannot say that the shells of this species are dimorphous, though there are specimens which are fuller in the posterior base than others. There is a considerable variation in the form, some of them having a slightly rounded basal line; in others it is incurved a little; some are considerably narrower in front while others are no wider behind, (leaving out the wing), than they are at the anterior end. There is frequently a single faint pseudocardinal in each valve.

The form from Cambodia, which is referred to *C. plicata*, is believed by Fischer to be different, and it may be *C. bellua*.

Cristaria occidentalis (Heude).

Shell long elliptical, rather solid, subinflated, with a small anterior wing and a larger irregular dorsal one; beaks subcompressed, their sculpture consisting of very faint, concen-

tric ridges; plications of the posterior slope few and small; posterior ridge very full and rounded on the earlier growth but fading out entirely in its later stages; posterior end nearly evenly rounded, very slightly pointed at the median line; center of the disks smooth, the epidermis around the border concentrically roughened, pale brownish in the center of the disks, darker around the border; pseudocardinals wanting; laterals feeble, one in each valve; beak cavities shallow with a row of pits pointing towards the anterior base; anterior scars irregular; posterior scars shallow; nacre in the cavity of the shell brownish, tinted with purple; that of the posterior end iridescent; the nacre of the anterior end and base is very solid and milky-white; prismatic border wide.

Length 135, height without the wing 80, with the wing 95, diam. 43 mm.

Western Se-tchouan, China.

Dipsas occidentalis Heude, Conch. Fluv. Nank., IX, 1885, pl. LXVI.

Barbala occidentalis Pætel, Conch. Sam., III, 1890, p. 175.

Cristaria plicata (part), Simpson, Syn., 1900, p. 583.

In the Synopsis I placed this species in the synonymy of *C. plicata,* but additional study of the Cristarias and the examination of an author's specimen incline me to think that, though very close to that species, it may be distinct. The beak sculpture is much more feeble, as are the posterior plications, the shell is more inflated, the posterior ridge is much fuller and the nacre is brighter than in that species. The nacre around the anterior border is very solid, more so than in any *Cristaria* I know. Its outline is very much like that of *plicata.*

Cristaria bellua (Morelet).

Shell somewhat trapezoidal, subsolid, slightly inflated, with a high, widely rounded posterior ridge, which extends to the extreme hinder point; beaks low, the umbonal region but little inflated, with about six wide, low, concentric ridges; posterior slope with a few folds, which show within and without; anterior and posterior dorsal wings moderate, the upper dorsal

line of the shell being nearly straight; growth lines irregular, becoming almost sulcate on the border of the shell; epidermis dark chestnut or blackish, shining in the middle of the disk; hinge line arched; there is a short curved lateral in each valve; pseudocardinals wanting or indicated by a mere raised line; escutcheon square; beak cavities shallow, with a few deep pits; anterior muscle scars irregular; posterior scars somewhat crescentic, their upper points reaching to the posterior ends of the laterals; nacre bluish-white, milky.

Length 140, height 100, diam. 60 mm.

Cambodia.

Anodonta bellua Morelet, Rev. et Mag. Zool., XVIII, 1866, p. 167.

Cristaria bellua Simpson, Syn., 1900, p. 584.

Compared with *C. plicata,* this species is more rhomboid, more inflated, and drawn out behind into a more decided point, this point being nearer the base line than in *plicata,* and its epidermis is more chestnut and not so much olive-colored. Its nacre is milky-white, that of *plicata* is not. The above description is from a specimen in the writer's collection, which came from Cambodia. Morelet's specimens are larger, his type being 173 millimeters in length.

Cristaria herculea (Middendorff).

Shell irregularly ovate, somewhat solid, inflated, with a very high, rounded or somewhat biangulate posterior ridge; beaks low but full, sculptured with a number of wide, low ridges running nearly parallel with the hinge line and extending well out on the shell; on the posterior slope there is a row of plications extending from the beaks towards the posterior end and below these folds there is a low, radial ridge; growth lines irregular; epidermis blackish on the body of the shell where it is developed into concentric lamellæ or ridges, and smooth and brownish on the earlier growth. There is a very feeble anterior wing and a low dorsal one; pseudocardinals wanting or represented by a mere raised line; laterals, one *in*

each valve, small and short; beak cavities shallow, with one or two muscle scars; adductor scars shallow; nacre lurid, purplish-white, often blotched.

Length 170, height 112, diam. 67 mm.

East Siberia; Amurland; North China. ?

Anodonta herculea MIDDENDORFF, Bull. Phys. Math. Ac. St. Pet., VI, 1848, p. 303.—Sib. Reise, II, 1851, p. 278, pl. XXI, fig. 5; XXII, figs. 1, 2; XXVI, figs. 1. 2.—DESHAYES, Bull. Nouv. Arch. Mus., IX, 1873, p. 1, pl. 1, fig. 1.

Anodonta (Dipsas) herculea CLESSIN, Conch. Cab. Ano., 1875, p. 175, pl. LIX, figs. 1, 2.

Cristaria herculea VON IHERING, Abh. Senck. Nat. Ges., XVIII, 1893, p. 146.—SIMPSON, Syn., 1900, p. 584.

Barbala herculea PÆTEL, Conch. Sam., III, 1890, p. 175.

Dipsas plicata var. *clessini* KOBELT, part, Abh. Senck. Nat. Ges., XI, 1879, p. 429, pl. XV.

There is a fine specimen of this species in the National Museum collection said to come from Japan. It differs from *C. spatiosa* in being shorter, more inflated, and in having a much higher posterior ridge, while the plications of the posterior slope are more strongly developed than in that species. From *plicata* it differs much in shape, being drawn out to a blunt, rounded posterior point at the median line; it is far more inflated than that species, and has a higher posterior ridge. Its posterior dorsal outline is somewhat incurved.

Craspedodonta smaragdina ANTON, Verz. der Conch., 1839, p. 16, No. 592; Clessin, Conch. Cab. Ano., 1875, p. 93, pl. XXVII, fig. 2; a badly figured little shell, said to come from North America; may be a young *C. herculea*.

CRISTARIA SPATIOSA (Clessin).

Shell enormously large, irregularly long ovate, with a slight wing behind, subsolid, somewhat inflated, gaping before and behind, with a full, widely rounded posterior ridge, which is either straight or curved downward in the middle; the outline of the shell above the posterior slope is incurved and it ends in a wide, feeble biangulation behind; beaks low, moder-

ately full, their sculpture not observed; surface with irregular growth lines, which become somewhat sulcate around the edge of the shell; epidermis, dark brown or blackish; hinge line regularly curved, with epidermal matter folded in throughout; pseudocardinals wanting; in each valve there is a short, imperfect lateral; beak cavities shallow, with two or more deep scars; nacre dull, white, somewhat thickened in front, sometimes showing the posterior dorsal plications, which are more distinct on the outside of the shell; muscle scars shallow. I cannot say that these shells are dimorphic, but certain specimens, which may be males, have a straight posterior ridge, which ends below the median line; in others it is upcurved behind and ends above the median line and these may be females.

Length 210, height 115, diam. 73 mm. This is an ordinary sized shell; a larger one measures: length 240, height 120, diam. 70 mm.

Japan. It seems to be abundant in Lake Biwæ.

Anodon herculeus SOWERBY, Conch. Icon., XVII, 1867, pl. III, fig. 7.

Anodonta (Dipsas) spatiosa CLESSIN, Conch. Cab. Anodonta, 1875, p. 173, pl. LVII, fig. 2.

Cristaria spatiosa VON IHERING, Abh. Senck. Nat. Ges., XVIII, 1893, p. 145.—SIMPSON, Syn., 1900, p. 584.

Barbala spatiosa PÆTEL, Conch. Sam., III, 1890, p. 175.

Dipsas plicata var. *japonica* KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 429, pl. XLVII.

A very large species, which has quite commonly been taken for *C. plicata*. It is solider and much more elliptical in outline than that species.

Subgenus PLETHOLOPHUS Simpson, 1900.

Plethlophus SIMPSON, Syn., 1900, p. 585.

Shell short-elliptical, lenticular, but little thickened in front, with compressed beaks, which are sculptured with low, wide, concentric ridges, scarcely winged in front or behind, pointed

posteriorly; epidermis smooth, somewhat rayed; hinge teeth very feeble, often nearly wanting; dorsal scars few; muscle scars faint. Animal unknown.

Type, *Symphynota discoidea* Lea.

CRISTARIA DISCOIDEA (Lea).

Shell nearly evenly elliptical, not inflated, thin but strong, lenticular; the beaks compressed, their sculpture consisting of feeble concentric ridges; with a low wing behind, which is straight on its dorsal edge; anterior end evenly rounded, wingless; base line regularly curved; the shell ends posteriorly in a blunt point at the median line; posterior ridge almost wanting; surface nearly smooth, yellowish-green, with a wide, faint, concentric, green band near the edge, the umbonal region pale brownish-green, very feebly rayed throughout; pseudocardinals wanting or reduced to mere raised threads, laterals scarcely developed, one in each valve; beak cavities shallow, with one or two scars in each; posterior dorsal plications wanting or only shown as mere vestiges; muscle scars shallow, the posterior crescentic; nacre bluish-white, minutely radially granulous; iridescent behind.

Length 90, height 55, diam. 28 mm.

Symphynota discoidea LEA, Tr. Am. Phil. Soc., V, 1834, p. 75, pl. XI, fig. 33; Obs., I, 1834, p. 187, pl. XI, fig. 33.

Barbala discoidea H. and A. ADAMS, Gen. Rec. Moll., II, 1858, p. 501.—CHENU, Man., 1859, II, p. 145, fig. 716.

Dipsas discoidea KUSTER, Conch. Cab. Unio, 1862, p. 306, pl. c, fig. 1.

Cristaria discoidea SIMPSON, Syn., 1900, p. 585.

Margarita (Unio) discoideus LEA, Syn., 1836, p. 47; 1838, p. 28.

Unio discoideus HANLEY, Biv. Shells, 1843, p. 214, pl. XXI, fig. 57.

Margaron (Unio) discoideus LEA, Syn., 1852, p. 46; 1870, p. 74.

Unio tenuis GRAY, Griffith's Cuv., XII, 1834, p. 601 (index), pl. XXIV, fig. 2.

Anodonta chinensis KUSTER, Conch. Cab. Ano., 1853, p. 51, pl. XII, fig. 3.

Unio magnificus SOWERBY, Conch. Icon., XVI, 1867, pl. LVII, fig. 289.

Anodonta gruneriana CLESSIN, Conch. Cab. Ano., 1875, p. 172, pl. LVI, figs. 3, 4.

There are often one or two dark rays on the posterior slope. It is a very neat shell and is sometimes so nearly destitute of teeth that it is taken for an *Anodonta*. Gray's and Lea's names were published in the same year and I have no means of knowing which appeared first.

Var. *sautteri* Haas.

"Differs from typical *discoidea* by the strongly developed claustra, which are double in the left valve in their præumbonal as well as in their postumbonal portion." (Haas.)

Type locality, Lake Candidins, Formosa.

Cristaria discoidea sautteri HAAS, Ann. Mag. Nat. Hist., (8), VI, 1910, p. 499.

CRISTARIA PARVULA (Heude).

Shell thin, small, long elliptical or obovate, subcompressed, rounded in front, with a small post-dorsal wing, which in well-preserved shells is angled behind; posterior ridge low, scarcely biangulate; beaks low and subcompressed, their sculpture a few longitudinal bars parallel to the dorsal line; surface with fine concentric growth marks, brownish or olive, rayless; plications of the posterior slope faint; left valve with a single, very faint, long and curved pseudocardinal and one low faint lateral; right valve with two feeble pseudocardinals and a single lateral; muscle scars faint; nacre bluish or purplish, iridescent.

Length 58, height 34, diam. 18 mm.

Kien-té sud; Canton River, China.

Dipsas parvulus HEUDE (part), Conch. Fluv. Nank., IV, 1878, pl. XXXII, fig. 65.

Barbala parvula PÆTEL, Conch. Sam., III, 1890, p. 175.

Cristaria parvula SIMPSON, Syn., 1900, p. 585.

I am doubtful whether this is more than a variety of *C. discoidea,* the specimen figured by Heude being a young shell. I have seen a shell, which I believe is Heude's species, that differs from the young of *C. discoidea* in being darker colored, a little rougher, and duller colored, in having longer, more delicate and more curved pseudocardinals, and a little darker nacre. All the young of *discoidea* I have seen are slightly biangulate behind; this is hardly so.

CRISTARIA REINIANA von Martens.

Shell elliptical or slightly rhomboid, rather thin, subcompressed, with a small post-dorsal wing, which is straight above and angular behind; posterior ridge but slightly developed, there being three faint darker ridges; beaks low and compressed, their sculpture consisting of feeble ridges parallel to the dorsal line; on the posterior slope there are sometimes a few slight plications; color greenish or brownish, sometimes rayed; there is a single rudimentary, linear pseudocardinal in each valve and one slender lateral; plications of the posterior slope scarcely developed; muscle scars shallow; nacre bluish-white.

Length 55, height 35, diam. 18 mm.

Length of largest National Museum shell 60, height 35, diam. 18 mm.

Japan.

Cristaria reiniana VON MARTENS, Jahrb. Mal. Ges., II, 1875, p. 136, pl. III, fig. 4.—SIMPSON, Syn., 1900, p. 585.

? Dipsas reiniana KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 432, pl. XII, fig. 4; XXI, fig. 2.

Anodonta reiniana VON IHERING, Abh. Senck. Nat. Ges., XVIII, 1893, p. 147.

Barbala reiniana PÆTEL, Conch. Sam., III, 1890, p. 175.

Plethholophus reiniana PRESTON, Rec. Ind. Mus., VII, 1912, p. 281.

The species is rather more rhomboid than *C. discoidea,* to which it is nearly related.

There are two Cristarias in the National Museum, said to come from Japan, that are a little longer in proportion than the described specimens, and a little more inflated at the posterior base, but it is probable that they are females.

CRISTARIA GENTILIANA Heude.

Shell somewhat elliptical, subsolid, compressed, with low beaks, with two dark, radiating lines on the posterior slope; the dorsal line not so much rounded as the basal one; with a very feebly developed anterior and posterior dorsal wing; rounded in front; the posterior point blunt and raised above the median line; epidermis black, apparently feebly rayed; right valve with two delicate, lamellar pseudocardinals and one lateral; muscle scars probably shallow; nacre greenish-purple, iridescent.

Length 80, height 50, diam. 20 mm.

Le-Fou-Kien, China.

Cristaria gentilianus HEUDE, Conch. Fluv. Nank., VII, 1881, pl. LIII, fig. 98.

Cristaria gentiliana SIMPSON, Syn., 1900, p. 586.

Barbala gentiliana PÆTEL, Conch. Sam., III, 1890, p. 175.

The epidermis is darker than that of *C. discoidea,* the nacre is differently colored, the pseudocardinals of the right valve are two in number, while in *discoidea* there is only one, and the shell is longer in proportion than shells of *discoidea* of the same size. Younger shells of the latter are often as much elongated as is Heude's species and I think it more than probable that it is only a variety of Lea's *discoidea.*

CRISTARIA SWINHOEI (H. Adams).

Shell rhombic obovate, thin, scarcely inflated, without a defined posterior ridge, but with a couple of very faint, dark ridges on the posterior slope; beaks low and compressed, their sculpture not discernible from the specimens examined; anterior end rounded and apparently without a dorsal wing; posterior dorsal wing moderate, ending behind in an angle; surface with irregular, concentric growth lines, rayless, green-

ish-yellow, sometimes with indistinct, darker, concentric bands; left valve with a small, lamellar pseudocardinal and one or two blurred, lamellar laterals; right valve with one pseudocardinal, with vestiges of one or two above it and a single delicate lateral; beak cavities shallow, with one or two faint scars; muscle scars shallow and indistinct; nacre bluish-white, somewhat iridescent and having a wide, prismatic border.

Length 55, height 34, diam. 20 mm.

Tonkin; Cambodia.

Anodonta swinhoei H. Adams, Proc. Zool. Soc. Lond., 1866, p. 446.—Clessin, Conch. Cab. Anodonta, 1876, p. 125, pl. LXXV, fig. 6.

Anodon swinhoei Sowerby, Conch. Icon., XVI, 1868, pl. XXVII, fig. 108.

Cristaria swinhoei Simpson, Syn., 1900, p. 586.

Plethlophus swinhoei Preston, Rec. Ind. Mus., VII, 1912, p. 281.

A species that evidently stands close to *C. discoidea* and *C. gentiliana*. It is rather more inflated and elongated than the former, and has more completely developed hinge teeth than either. The laterals of this species are sometimes split up as in *Symphynota compressa*.

Cristaria inangulata Haas.

"Shell short-elliptical, nearly unwinged, rather thin and inflated, rounded in front and behind. Posterior ridge rounded, low. Basal margin regularly curved. Beaks not prominent, situated at 35/100 of the total length, with low, wide ridges grouped round an apical protuberance, the first ones doubly looped, the following ones becoming slightly undulate. Epidermis greenish-brown, shining, rayed. Hinge consisting of a single, low, lamellar præumbonal, and a single, low, nearly reduced, postumbonal claustrum in each valve. Anterior cicatrices faint, that of the anterior adductor and that of the anterior retractor confluent. Posterior cicatrices confluent, faint; 2-3 dorsal cicatrices lying in a row, often united in a groove,

situated under the beaks. Beak cavities shallow. Nacre reddish, bluish towards the edge.

Length 99, height 59, diam. 39 mm." (Haas.)

Cristaria inangulata Haas, Ann. Mag. Nat. Hist., (8), 1910, VI, p. 499.

Cristaria nicobarica (Morch).

"Shell irregularly oval, slightly convex; lines of growth irregular; the marginal half of the shell olivaceous, with very many obscure, radiating, obsolete, faint green rays. Within silvery, iridescent posteriorly. Umbones anterior, flat, eroded; dorsal margin slightly curved; anterior margin rounded, narrower; ventral margin quite curved in front and behind, slightly incurved in the middle; posterior margin somewhat narrow, bent. Cardinal teeth almost wholly wanting; lateral tooth linear, nearly obsolete." (Morch.)

Type locality, Nicobar Islands.

Mytilus nicobaricus Fabricius, Catalogue, 1825, p. 65.

Alasmodonta (subg.?) *nicobarica* Morch, Jl. de Conch., XX, 1872, p. 327.

Pseudodon nicobaricus Simpson, Syn., 1900, p. 838.

"*Anodonta zollingeri* Mousson (Java, p. 96, t. xviii, f. 1) is similar, but the species of Fabricius differs: in the curved ventral margin, suddenly ascending posteriorly, as well as in the margin of the dorsal slope, which is not at all curved." (Morch.)

Fabricius gave no description of his *Mytilus nicobaricus*, so that the species must be credited to Morch.

In the Synopsis I placed this species in *Pseudodon* in reliance upon Morch's comparison with *P. zollingeri* Mss. I have recently been favored with the following note on the species from Dr. F. Haas: "I have been able to obtain the type of this species from Copenhagen and to determine that it is to be referred to the genus *Cristaria*. There is only a single specimen known and that has been ground off on the edges, so that the shape has been changed. Nevertheless I consider *Cr. nicobarica* a good species, related to my *C. inangulata*."

Subgenus Crassitesta Simpson, 1900.

Crassitesta Simpson, Syn., 1900, p. 586.

Shell rather solid, elliptic-rhomboid, with a rounded posterior ridge, scarcely winged; beaks full, sculpture not seen; epidermis bright, strongly rayed, with two conspicuous light and three dark rays on the posterior slope; hinge line curved; pseudocardinals and laterals reduced to the merest vestiges; dorsal scars only one or two in the cavity of the beaks; adductor scars faint; nacre lurid.

Type, *Cristaria radiata* Simpson.

Cristaria radiata Simpson.

Shell elliptic rhomboid, rather solid, somewhat inflated, with a full, rounded posterior ridge; anterior wing wanting; posterior wing but slightly developed; beaks full, elevated above the dorsal line, much eroded in the specimens seen, but apparently having somewhat doubly-looped sculpture; surface shining, greenish-yellow with narrow and wide green rays; on the posterior slope there are two distinct, yellowish rays; hinge line evenly curved; only the faintest vestiges of pseudocardinals and laterals are developed; beak cavities shallow, with one or two pits; muscle scars shallow; nacre bluish-white, dull, often blotched, not thickened in front.

Length 73, height 45, diam. 28 mm.

Kien-té sud, (Ngan-houé), China.

Dipsas parvulus Heude (part), Conch. Fluv. Nank., VII, 1881, pl. LII, fig. 96.

Cristaria radiata Simpson, Syn., 1900, p. 586.

I do not know where to place this species, which is so different from the other Cristarias that it may not belong to that genus at all. Heude applied the name *Dipsas parvulus* to two entirely distinct forms, figuring the first on plate XXXII of the Conchyliologie Fluviatile Nanking and the present species on plate LII, hence I have given the last figured form a new name. I do not think it can be an *Anodonta* and it may be the type of a distinct genus.

Genus LEPIDODESMA Simpson, 1896.

Lepidodesma Simpson, Pr. U. S. Nat. Mus., 1896, p. 311.

Shell large, thin, inflated, with a high, sharp posterior ridge and a second fainter one above it, making the hinder part widely biangulate; beaks very high and full, their sculpture, which extends over the whole shell, consisting of ridges that follow the growth lines; there are two rows of radiating nodules, one on the middle of the disk, and a stronger one on the post-ridge; ligament very large, wide, covered with concentric scales; hinge line arched; there are two pseudocardinals in the left valve, the anterior elongated, running inwardly across the hinge plate and ending abruptly; a shorter, fainter one stands behind it; with two strong laterals, the inner the higher, its edge reflexed upward, and suddenly truncate behind; there is one low, elongated pseudocardinal in the right valve, and one lateral, which is reflexed upward; epidermis folded into the hinge and scaly; a single dorsal scar on the inner side of each hinge plate; muscle scars united, pallial line distinct; beak cavities large and wide; nacre very dull. Animal unknown.

Type, *Unio languilati* Heude.

Lepidodesma languilati (Heude).

Shell large, scarcely subsolid, inflated, subtriangular, with two distinct posterior ridges, which curve down in the middle, the lower the higher, the two marking the limit of a wide, decided posterior truncation; base line nearly straight; posterior slope obliquely truncated; ligament very large, dark brown and covered with crescentic scales; the pit in which it is lodged extends forward under the beaks and is filled with epidermal matter; beaks very high and full, their sculpture consisting of coarse, doubly-looped and doubly-noduled ridges, the bases of the loops and the nodules occurring on the posterior ridges; surface covered with very strong ridges, which follow the growth lines; epidermis greenish in young shells, ash-colored in old ones; left valve with two compressed pseudo-

cardinals, the anterior the longer, and two short, curved laterals, the lower much higher and reflexed upward, the upper deflected downward; right valve with one feeble pseudocardinal and a strong, reflexed lateral; beak cavities deep and wide; dorsal scars in a row under the anterior part of the hinge plate; adductor scars shallow; nacre dirty white, dull purplish behind, lusterless.

Length 170, height 120, diam. 85 mm.

Deep River, Kiang Nan, China.

Unio languilati HEUDE, J. de Conch., XXII, 1874, p 116; Conch. Fluv. Nank., I, 1875, pl. VII.

Lepidodesma languilati SIMPSON, Pr. U. S. Nat. Mus., XVIII, 1896, p. 311.

Lepidodisma languilati SIMPSON, Syn., 1900, p. 587.

Cristaria megadesma VON MARTENS, S. B. Nat. Fr., 1875, p. 3; Nov. Conch., IV, 1876, p. 152, pl. CXXXV, fig. 1.

Barbala megadesma PÆTEL, Conch. Sam., III, 1890, p. 175.

A most remarkable and magnificent Naiad, whose relations are a little in doubt, as nothing is known of its anatomy. The beak sculpture resembles that of *Anodonta grandis* in its earlier stage and later that of some of the Cristarias. A young and an adult shell are in the National Museum collection, from the author.

LEPIDODESMA ALIGER (Heude).

Shell very large, irregularly triangular, inflated, with high beaks, whose sculpture has not been observed, with a double posterior ridge, the lower one very strong above, which ends behind in a wide biangulation, the shell being rather squarely truncate posteriorly; post-dorsal wing high, covered with scattered nodules, which extend on to the posterior slope and are often turned to one side; anterior end rounded; base line straight or slightly incurved, rounded up a little behind; surface strongly sulcate throughout; ligament partially covered by the wing; no measurements are given by Heude. His figure is 195 mm. in length and 157 in height.

China.

Unio languillati var. *aligerus* HEUDE, Conch. Fluv. Nank., III, 1877, pl. XVII, fig. 37.

Lepidodesma aligera SIMPSON, Pr. U. S. Nat. Mus., XVIII, 1896, p. 311; Syn., 1900, p. 587.

Heude believes this to be a variety of his *Unio languilati*, but although he gives no description, the figure is so different from the type that I should think this form worthy of specific rank. The concentric sculpture is much finer than it is in *languilati*, where it consists of coarse ridges; the posterior ridges are more strongly curved and the pustules are more distinctly developed.

Genus PILSBRYOCONCHA Simpson, 1900.

Pilsbryoconcha SIMPSON, Syn., 1900, p. 587.

Shell elongated, elliptical, compressed, thin, with a low, posterior wing, narrow and rounded in front, nearly straight below, expanded at the post-basal region, pointed behind. Beaks compressed, sculptured with several coarse, low, irregularly concentric undulations, often slightly doubly looped; surface nearly smooth, shining, yellowish to ashy-brownish, sometimes showing very faint rays; hinge straight or slightly curved, reduced to a mere line, often showing a faint, compressed, smooth tooth in front of the beaks, otherwise edentulous; nacre brilliant, silvery and iridescent; muscle scars faint. Animal pure milky-white; lobes of the mantle united into two short siphons.

Type, *Anodonta exilis* LEA.

PILSBRYOCONCHA LINGUÆFORMIS (Morelet).

Shell irregularly obovate or subtrapezoidal, compressed, rather thin, with a moderate posterior wing, behind, which it is obliquely truncated, with a low, rounded posterior ridge; beaks low, their sculpture consisting of nearly straight ridges, which are almost parallel with the dorsal line; dorsal line somewhat curved; surface sculptured with numerous concentric growth lines; epidermis ashy to yellow-brown, shining;

hinge edentulous or with the merest vestiges of teeth under the beaks; beak cavities shallow, with a diagonal row of faint scars; nacre soft and shining, bluish or purplish, iridescent, salmon-colored in the beak cavities. The specimen from the Morelet collection belonging to the National Museum and bearing Morelet's label *Anodonta linquæformis* differs quite a little from the figure of the type and is probably a female shell as it is considerably produced in the post-basal region. The figure of the type shows a shorter, higher shell, with no post-basal inflation. Both are bluntly pointed about at the median line.

Length of type 105, greatest height 47, diam. 18 mm.

Length of Museum specimen 96, height 52, diam. 20 mm.

Siam; Cambodia.

Anodonta linguæformis MORELET, Ser. Conch., IV, 1875, p. 329, pl. XIV, fig. 5.

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

Pilsbryoconcha linguæformis SIMPSON, Syn., 1900, p. 587.

Morelet's measurements are of a longer, narrower shell than the one described, his figure being 93 millimeters in length and 55 in height. It may be that this is only a variety of Lea's *Anodonta exilis*.

PILSBRYOCONCHA SUILLA (von Martens).

"Shell oblong, inflated, rather thin, striate; epidermis blackish-brown; roundly produced in front; higher and more inflated behind; dorsal margin subconcave anteriorly, posteriorly from the beaks to the sinulus quite ascending and obtusely subalate, thence descending; posterior margin truncate, subvertical; ventral margin for the most part straight, horizontal; beaks depressed, with rather strong undulating ridges, conspicuous even when eroded; hinge line in front of the beaks simple, narrow, slightly sinuous and at first sharply descending, then rising, behind the beaks, convex, with a heavy nacreous deposit and towards the sinulus decidedly wider;

sinulus small, obtusely angled; nacre bluish, changing to red towards the beaks; muscular impressions shallow.

Long 88; alt. vert. 42.5, alæ 61, diam. 36 mm. Beaks at 1-3 of the length." (von Martens).

Type locality, Tonkin.

Anodonta suilla VON MARTENS, Nachr. Deutsch. Mal. Ges., 1902, p. 130.

"In profile, it reminds one most of *An. linguæformis* Morelet, which Simpson refers to *Pilsbryoconcha*, but it is much more inflated, the beaks are less polished, with strong, irregular, almost ridge-like lines of growth. From *An. joudyi* Morlet, which was collected by Fruhstorfer in Phuc-Son, Annam, it is easily distinguished by its straight basal margin and more angulated, projecting anterior margin."

PILSBRYOCONCHA EXILIS (Lea).

Shell long obovate, thin, compressed, narrowed and evenly rounded in front, slightly winged behind, the dorsal line straight; posterior ridge low, widely rounded or feebly biangulate, with a shallow radial furrow above it; beaks compressed, their sculpture consisting of delicate ridges, which run nearly parallel with the dorsal line; post-basal region considerably produced and widely rounded; posterior point rather sharp, mid-way up from the base; growth lines irregular, somewhat sulcate at the outer edge, the posterior slope having numerous delicate folds, which follow the growth lines; epidermis pale brown, smooth; hinge a mere line, edentulous or sometimes having a single, low, smooth anterior tooth or prominence in each valve; beak cavities very shallow, with two or three scars; adductor scars very indistinct; nacre brilliant, richly iridescent.

Length 85, height 43, diam. 15 mm.

Southeastern Asia, Sumatra, Java.

Anodonta exilis LEA, Tr. Am. Phil. Soc., VI, 1839, p. 81, pl. XXII, fig. 68; Obs., II, 1838, p. 81, pl. XXII, fig. 68.— CLESSIN, Conch. Cab. Ano., 1875, p. 171, pl. LVI, figs. 6-8.

Margarita (Anodonta) exilis LEA, Syn., 1838, p. 32.

Anodon exilis CATLOW and REEVE, Conch. Nom., 1845, p. 66.
Margaron (Anodonta) exilis LEA, Syn., 1852, p. 51; 1870, p. 82.
Monocondylæa exilis PÆTEL, Conch. Sam., III, 1890, p. 174.
Pilsbryconcha exilis SIMPSON, Syn., 1900, p. 587.
Anodonta siliqua KUSTER, Conch. Cab. Ano., 1852, p. 57, pl. XIV, fig. 5.
Anodonta polita MOUSSON, L. and Suss. Moll. Java, 1849, p. 98, pl. XIX, figs. 2, 3.
Margaron (Anodonta) polita LEA, Syn., 1852, p. 53.
Anodon politus SOWERBY, Conch. Icon., XVII, 1867, pl. XII, fig. 36.
Monocondylæa compressa LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 190; Jl. Ac. N. Sci. Phila., VI, 1866, p. 30, pl. XI, fig. 29; Obs., XI, 1867, p. 34, pl. XI, fig. 29.— CLESSIN, Conch. Cab. Ano.., 1876, p. 258, pl. LXXX, figs. 3, 4.
Pseudodon compressa CONRAD, Am. Jl. Conch., I, 1865, p. 233.
Margaron (Monocondylæa) compressa LEA, Syn., 1870, p. 73.
Spatha compressa PÆTEL, Conch. Sam., III, 1890, p. 188.
Anodon javana SOWERBY, Conch. Icon., XVII, 1867, pl. XI, fig. 33.
Anodon gracilis SOWERBY? Conch. Icon., XVII, 1867, pl. XIX, fig. 45.
Anodon kelletti SOWERBY? Conch. Icon., XVII, 1867, pl. XIX, fig. 71.
Anodonta sempervirens DESHAYES, Nouv. Arch. de Mus., X, 1874, p. 120, pl. V, figs. 4, 5.

An exceedingly delicate shell, which does not vary remarkably, yet it has received a large number of names. There is often an especially rich, greenish, iridescent, concentric band near the border inside.

PILSBRYOCONCHA EXPRESSA (von Martens).

"Shell compressed, elliptic-ovate, well rounded in front, obtusely alate behind, posterior margin oblique, ventral margin straight to the middle, roundly expanded posteriorly; epidermis concentrically striate, shining; beaks depressed, with un-

dulate sculpture, situated at 1-5 (in the young 1-4) of the length; nacre bluish, towards the beaks lurid yellow.

a) Long. 118, alt. vert. 53, alæ 69, diam. 27 mm.

b) Long. 103, alt. vert. 45, alæ 55, diam 22.5 mm.

c) Long. 88, alt. vert. 35, alæ 47, diam. 18 mm.

d) Long. 68, alt. vert. 27, alæ 37, diam. 12 mm." (von Martens).

Type locality, Lake Danau-Baru, Indragiri, Sumatra.

Anodonta expressa VON MARTENS, Nachr. Deutsch. Mal. Ges., 1900, p. 12.

"Nearest to *A. exilis* Lea from Siam and *A. polita* Mouss. from Java, but it is easily distinguished in the mature form by the greater height of the posterior half of the shell. The four specimens before me form an age series and show that the proportion of height to length increases noticeably with age; the two younger shells, c and d, remind one very much of *A. polita* from Java, especially as in c the bright yellow border is also present, but the ventral margin is a little more convex posteriorly and the posterior margin descends more direct from the wing. In the older shells, a and b, this is still more so. In the young shells the surface is somewhat dull, but is polished in the older ones, which are of a dark brown color like the two species referred to."

PILSBRYOCONCHA CARINIFERA (Conrad).

Shell narrow, elliptical, compressed, thin and fragile; anterior side narrow, rounded at the extremity; posterior side produced, subcuniform, truncated at the extremity; hinge margin long, straight, elevated, slightly ascending from the anterior to the posterior extremity; beaks not elevated above the dorsal line; basal margin straight in the middle; color of epidermis olive-green inferiorly, darker above; hinge margin without a callus.

Length 65, height 30, diameter not given.

Southeastern Asia, probably.

Anodonta carinifera CONRAD, Cover of Monography, No. 9, 1837.

Pilsbryconcha carinifera SIMPSON, Syn., 1900, p. 588.

The above is Conrad's description on the cover of the Monography, No. 9. He gives "Rivers of Kentucky, from Mr. John Phillips, who stated that it was from the Ohio or a tributary below Louisville." No specimen so named can be found in Conrad's collection, but Dr. Pilsbry found an unnamed shell in the Conrad collection, which agrees very well with the above description, which could not have come from Kentucky, but which is undoubtedly a *Pilsbryoconcha*.

PILSBRYOCONCHA LEMESLEI (Morelet).

Shell elongated, slightly wider behind and arcuate when old, thin, shining; somewhat compressed, especially posteriorly, with a low rounded posterior ridge; anterior end rounded; posterior end with a rounded, somewhat narrowed point a short distance above the base; surface irregularly sulcate, light brown, rayless; area of the beaks extensively eroded in the specimen figured, the eroded part being coppery-brown, nacre bluish, iridescent with yellow-brown spots in the center of the shell; hinge edentulous.

Length 81, height 32, diam. 14 mm.

Cambodia, probably near Battambang, Siam.

Anodonta lemeslei MORELET, Ser. Conch., IV, 1875, p. 328, pl. XIV, fig. 1.

Pilsbryoconcha lemsleyi SIMPSON, Syn., 1900, p. 588.

The type is an old, elongated, rather peculiar shell. Conrad's species may be the young of it, and Morelet believes that Marten's *A. schomburgki* is very close to his shell. I have not seen a sufficient amount of material of this genus to determine with certainty whether all these are valid species.

PILSBRYOCONCHA SCHOMBURGKI (von Martens).

"Shell elongate, narrow in front, expanded behind, compressed, thin; epidermis shining, greenish; dorsal margin nearly straight, elevated posteriorly into a low, rather long wing; anterior and posterior margins rounded, without distinct angles; ventral margin subconcave; hinge distinctly edentulous;

muscular impressions moderate, anterior accessory impression moderate, subrhomboid; nacre violaceous red.

Length 82, height, at beaks, 27, at posterior end, 38 diam. 15 mm." (von Martens).

Anodonta (Lamproscapha) schomburgki VON MARTENS, Pr. Zool. Soc. Lond., 1860, p. 15.

Pilsbryoconcha schomburgki SIMPSON, Syn., 1900, p. 588.

I know nothing of this species. Von Martens remarks that "the thin and very flat shell and the want of edges at the margins render it impossible to associate this species with *Spatha rostrata*." I presume that it should be placed in *Pilsbryoconcha* and it is possible that it is synonymous with some one of the other species here described.

Genus MEDIONIDUS Simpson, 1900.

Medionidus SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 77.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 334.

Shell elongated, rather inflated, often arcuate when adult, generally having a posterior ridge; dorsal slope and occasionally the posterior portion of the shell plicately or nodulously wrinkled; epidermis smooth and bright, variegated with broken green rays and blotches; beak sculpture consisting of rather fine, subparallel, often broken ridges in two loops, the anterior rounded, the posterior somewhat angled, occasionally broken up into zigzags; pseudocardinals small, stumpy, and somewhat roughened; laterals rather short, slightly curved and club-shaped, remote; dorsal cicatrices few, placed under the hinge just behind the beaks; anterior cicatrices rather deep; posterior cicatrices rounded, large, and well impressed; anterior part of shell somewhat thickened; female shell slightly swollen just behind the middle of the base.

Animal having inner gills wholly or in part free from the abdominal sac; marsupium occupying the central posterior part of the outer gills, sometimes extending nearly their whole length, consisting of few to many rather large, irregular ovi-

sacs, which are not so distinctly marked out as in *Lampsilis*, but which have rounded bases; mantle much thickened on its lower edge, which is dark colored and sometimes papillous.

Type, *Unio conradicus* Lea.

This genus contains a few rather closely related species which are found in the Tennessee, Alabama and Chattahoochee river systems and southeast to the Suwanee River, Florida. It is closely related to *Lampsilis*, but the embryos are contained in irregular, though distinctly marked, ovisacs near the center of the outer gills instead of in regular ovisacs at the hinder part of the gills. The marsupial swelling of the female shell is less developed than in *Lampsilis* and is placed farther forward than in that genus. The male shell is generally somewhat arcuate and the species generally have a well-developed posterior ridge, characters not often found in *Lampsilis*.

KEY TO SPECIES OF MEDIONIDUS.

Shell without a posterior ridge. *M. conradicus.*
With a posterior ridge.
Marked with undulating or broken rays.
Solid. *M. kingi.*
Subsolid or thin. *M. parvulus, penicillatus, simpsonianus, acutissimus.*
Without rays. *M. walkeri.*

Group of *Medionidus conradicus*.

Shell small, usually with a well-defined posterior ridge; posterior end and sometimes the greater part of the shell slightly wrinkled or nodulous; epidermis rather smooth, painted with rays broken into irregular arrow-head markings or blotches; pseudocardinals rather small and imperfectly developed; laterals of left valve separated by a narrow, shallow furrow; nacre greenish, purplish, or bluish. The male shell is often decidedly arcuate; that of the female is swollen at or behind the center of the base. Animal having the character of the genus.

MEDIONIDUS CONRADICUS (Lea).

Shell rather small, long elliptical, usually arcuate, especially when fully adult, subinflated, subsolid, inequilateral, rounded in front, with a low, sometimes scarcely developed, posterior ridge ending in a rounded point at the posterior base; beaks only slightly inflated, but little elevated, sculptured with fine, irregular corrugated ridges, which have a tendency to fall into two loops; posterior end, especially the dorsal slope, generally more or less wrinkled, sometimes the anterior half of the shell shows slight corrugation; epidermis scarcely shining, tawny to yellowish-green, with feeble, broken, wavy darker rays, which sometimes show a tendency to break into blotches or arrow-head markings; left valve with two stumpy pseudocardinals and two laterals; right valve with one pseudocardinal and one lateral; anterior scars deep; posterior scars shallow; beak cavities but slightly excavated; nacre bluish to dirty flesh-color. The male shell is generally considerably arcuate and is often wider behind; that of the female is a little produced along the middle of the base, and this part of the shell is sometimes faintly, radially grooved. It is considerably thickened in front.

Length (male) 55, height 25, diam. 16 mm.

Length (female) 42, height 18, diam. 14 mm.

Tennessee River drainage; Cahawba River, Alabama, and probably the entire Alabama River system.

Type locality unknown.

Unio conradicus LEA, Tr. Am. Phil. Soc., VI, p. 63, pl. IX, fig. 23; Obs., I, 1834, p. 175, pl. IX, fig. 23.—HANLEY, Biv. Shells, 1843, p. 176, pl. XXIII, 22.—KUSTER, Conch. Cab., Unio, 1861, p. 179, pl. LVI, fig. 5.—SOWERBY, Conch. Icon., XVI, 1866, pl. LIV, p. 278.

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

Margaron (Unio) conradicus LEA, Syn., 1852, p. 21.

Medionidus conradicus SIMPSON, Syn., 1900, p. 589.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 335, fig. 22.

Unio conradius CONRAD, Monog., X, 1838, p. 87, pl. XLVII, fig. 3.
Margaron (Unio) conradianus LEA, Syn., 1870, p. 32.
Unio conradianus B. H. WRIGHT, Check List, 1888.

Very closely allied to the following, but it has a smoother shell, a less developed posterior ridge and is more rounded posteriorly.

MEDIONIDUS PARVULUS (Lea).

Shell small, elongated, subcompressed, subsolid, somewhat rhomboid, with a low, rounded posterior ridge, above which it is corrugately plicate; in front of it the surface is smooth; beaks moderate, their sculpture not seen; surface greenish or yellowish, marked with delicate, green, undulating or zigzag lines, which sometimes form very faint rays; pseudocardinals small and with the laterals much as are those of the other species of the group; nacre bluish-green.

Length 40, height 20, diam. 11 mm.

Coosa River, Alabama; Chattanooga and Swamp creeks, northwest Georgia.

Type locality, Coosa River, Ala.; Chattanooga, Georgia.

Unio parvulus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 307; Jl. Ac. N. Sci. Phila., VI, 1866, p. 45, pl. XVI, fig. 43; Obs., XI, 1867, p. 49, pl. XVI, fig. 43.
Margaron (Unio) parvulus LEA, Syn., 1870, p. 32.
Medionidus parvulus SIMPSON, Syn., 1900, p. 590.

A doubtful species, but I can hardly connect it with any of the others. It may be a variety of the *conradicus*, but it is smoother, differently colored and more delicate. All the shells I have seen are females and are slightly produced near the center of the base. The posterior point is somewhat raised above the basal line.

MEDIONIDUS PENICILLATUS (Lea).

Shell small, long rhomboid, subinflated, subsolid, inequilateral; beaks scarcely elevated, their sculpture not seen; posterior ridge moderately developed, rounded in the adult state,

sometimes angular in the young shell; epidermis rather smooth and shining, yellowish to greenish, showing faint darker rays, which are more or less broken and are made up of looped or zigzag lines; posterior slope quite strongly corrugated; left valve with two short, stumpy pseudocardinals and two delicate laterals; right valve with one pseudocardinal and one lateral; nacre purplish or greenish, often lurid and spotted. The male shell is slightly arcuate and nearly straight on the base line; that of the female is somewhat more fully developed ventrally.

Length (male) 40, height 22, diam. 13 mm.

Length (female) 28, height 15, diam. 10 mm.

Chattahoochee and Flint Rivers, Georgia.

Type locality, Chattahoochee River, Columbus; Atlanta; Flint River, Albany, Georgia.

Unio penicillatus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 171; Jl. Ac. N. Sci. Phila., IV, 1859, p. 203, pl. XXIII, fig. 85; Obs., VII, 1859, p. 21, pl. XXIII, fig. 85.

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

Medionidus penicillatus SIMPSON, Syn., 1900, p. 590.

This species has a rather shorter shell than any other member of the group. It is smoother than *conradicus* and is less arcuate and has a lower posterior ridge than *acutissimus*.

MEDIONIDUS SIMPSONIANUS Walker.

"Shell small, rather thin, somewhat inflated, elliptical, inequilateral, strongly plicate on the posterior slope. Epidermis dark yellow, smooth, polished, covered with dark green pencilled rays, which tend to break into a network of angular lines covering the entire surface. Anterior end compressed, rounded, and slightly elevated above the line of the hinge superiorly; posterior extremity obtusely rounded, the tip nearly on the median line of the shell; posterior ridge somewhat angled; dorsal slope covered with strong, subconcentric, somewhat irregular ridges extending from the posterior ridge to the margin; basal margin regularly curved; hinge margin nearly straight, slightly angled between the cardinal and lateral teeth.

Cardinal teeth crenulate, erect, rather compressed, those in the left valve nearly on the same line; lateral teeth slender, straight and nearly smooth. Anterior cicatrices well impressed, posterior cicatrices distinct, dorsal cicatrices under the plate behind the cardinal teeth. Beak cavity rather shallow, cavity of the shell deep and uniform. Nacre bluish-white, rather thicker anteriorly.

Length 36, height 19, diam. 13 mm." (Walker).

Type locality, Calvary, Georgia.

Medionidus simpsonianus WALKER, Naut., 1905, XVIII, p. 136, pl. IX, figs. 4-5.

"This species belongs to the *conradicus* group of *Medionidus* as defined by Simpson, and is most nearly related to *M. penicillatus*. But it differs decidedly from all the described species in the compression of the anterior end, the elevation of the superior-anterior margin and the regularly rounded posterior margin, which is equally curved above and below, the tip being on the median line and not depressed towards the basal margin as in all the allied species. The ridges on the posterior slope are quite strong, but not so numerous as in *M. kingi*."

MEDIONIDUS KINGI (B. H. Wright).

Shell small, elongate, solid and somewhat inflated, with a well-developed posterior ridge, which is bluntly angled or rounded, with rather full, high beaks, whose sculpture consists apparently of slightly doubly-looped ridges; posterior slope having strong, curved, radial ribs; there are sometimes a few slight corrugations on the body of the shell; surface hardly shining, tawny, with feeble, broken, dark rays, which are often split up into wavy, irregular hair lines; pseudocardinals small, solid, triangular, two in the left valve and one in the right; there are two slender laterals in the left valve and one in the right; anterior scars well marked; posterior scars shallow; nacre lurid purple, iridescent behind. The male shell is somewhat arcuate, its rounded posterior point being

at the base of the shell; in the female shell, which is smaller, the posterior point is considerably elevated above the base and the marsupial area is decidedly swollen.

Length (male) 45, height 23, diam. 16 mm.

Length (female) 36, height 18, diam. 15 mm.

Type locality, branch of Flint River, Baker County, Georgia.

Unio kingi B. H. WRIGHT, Nautilus, XII, 1900, p. 139.

Medionidus kingi SIMPSON, Syn., 1900, p. 590.

This species is more solid than any member of the group. It is considerably inflated, and has a more tawny epidermis than any of the others.

MEDIONIDUS ACUTISSIMUS (Lea).

Shell small, subinflated, rhomboid, with a high, sharp, sometimes slightly double posterior ridge; beaks rather prominent, their sculpture not observed; posterior slope and sometimes the greater part of the shell corrugately folded; surface shining, yellowish or greenish, marked with faint rays composed of zigzag or broken lines; left valve with two stumpy pseudocardinals and two laterals; right valve with one pseudocardinal and one lateral, nacre salmon, flesh-color or whitish, purple or reddish. Male shell arcuate, the hinder end drawn down to a sharp point at the posterior base; in the female shell this point is elevated a little above the base line and the middle of the base is swollen.

Length (male) 45, height 20, diam. 18 mm.

Length (female) 35, height 17, diam. 13 mm.

Alabama River system.

Type locality, Alabama River.

Unio acutissimus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 89, pl. x, fig. 18; Obs., I, 1834, p. 99, pl. x, fig. 18.—CONRAD, Monog., X, 1838, p. 86, pl. XLVII, fig. 2.—HANLEY, Biv. Shells, 1843, p. 177, pl. XXII, fig. 35.—CHENU, Ill. Conch., 1858, pl. VIII, figs. 3, 3*a*, 3*b*.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVI, fig. 189.

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

Margaron (Unio) acutissimus LEA, Syn., 1852, p. 21; 1870, p. 32.

Medionidus acutissimus SIMPSON, Syn., 1900, p. 590.

Unio semiplicatus KUSTER, Conch. Cab. Unio, 1862, p. 279, pl. XCIV, fig. 4.

Unio rubellinus LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 32; Jl. Ac. N. Sci. Phila., IV, 1858, p. 70, pl. XIII, fig. 51; Obs., VI, 1858, p. 70, pl. XIII, fig. 51.

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

Unio rubellianus SOWERBY, Conch. Icon., XVI, 1868, pl. XC, fig. 490.

Lea's *Unio acutissimus* seems to be merely a young and somewhat compressed form of *rubellinus*, which is adult and considerably inflated. The species of this group are close and often difficult to satisfactorily determine. This form is more inflated and has a higher, sharper posterior ridge than any of the rest, and the male is more decidedly arcuate.

There is a *Unio semiplicatus* of Troschel in Wiegman's Archiv. for 1841, p. 180, but I do not know what it is. Kuster credits his species to Australia, but it is evidently Lea's shell, no such species being found in Australia.

Group of *Medionidus walkeri*.

Shell rather short, inflated, with a high posterior ridge; posterior slope strongly corrugated; epidermis dark, slightly clouded; nacre reddish or greenish.

MEDIONIDUS WALKERI (B. H. Wright).

Shell subrhomboid, rather short, solid, slightly inflated, with a high, angled posterior ridge; beaks full, moderately high, their sculpture not observed; posterior slope covered with radiating, curved corrugations; the remainder of the shell with strong, irregular growth lines, sometimes feebly corrugated; epidermis dark, apparently unicolored, but when viewed by transmitted light it is often clouded or spotted, sometimes having a few angular, dark spots, but never rayed; left valve

with two somewhat compressed, but solid, pseudocardinals and two small laterals; right valve with one pseudocardinal and one lateral; nacre reddish or greenish, iridescent behind, much thickened in front. The male shell is decidedly rhomboid, being straight on the base, bluntly pointed at the posterior basal part, and obliquely subtruncate on the posterior slope. The female shell is considerably swollen just behind the central base and has the posterior point raised above the base line. The female shell is smaller than that of the male.

Length (male) 42, height 23, diam. 16 mm.

Length (female) 36, height 22, diam. 14 mm.

Type locality, Suwanee River, Madison Co., Florida. Also Ochlocknee River, Georgia.

Unio walkeri B. H. Wright, Naut., XI, 1897, p. 91.

Medionidus walkeri Simpson, Pr. Ac. N. Sci. Phila., 1900, p. 77, pl. 1, fig. 5; Syn., 1900, p. 591.

Quite distinct from the other species of the genus, as it has a high, well-defined posterior ridge and a dark, rayless epidermis, which, when fresh, is almost cloth-like.

Genus NEPHRONAIAS Fischer and Crosse, 1893.

Nephronaias Fischer and Crosse, Miss. Sci., II, 1893, p. 556.

Nephronajas Ortmann, Ann. Car. Mus., VIII, 1912, p. 324.

Shell elliptical, biangulate behind, that of the male showing a tendency to become arcuate with age, the female usually having a posterior inflation and never arcuate; surface concentrically sculptured; beaks low, with faint, broken ridges, which show a tendency to fall into two rounded loops; pseudocardinals generally rather compressed, ragged; laterals obliquely ridged; cavity of the beaks rather deep, dorsal muscle scars distinct, running in a line from the beak cavity downward and forward. Animal having the branchiæ rounded below, outer the larger behind, inner the larger anteriorly, free from the abdominal sac for all or part of their length; mantle thick-

ened on the edge, which is often dark colored; anal and branchial openings large and well furnished with papillae. Nothing is known of the marsupium of any members of this group, the animals examined probably being males; but it is most likely that when gravid the ovules will be found in distinctly marked ovisacs in the posterior part of the outer gill, something as in *Lampsilis*.

Type, *Unio plicatulus* Charpentier.

The genus *Nephronaias*, as diagnosed in the Synopsis and the present work, consists of some twenty or more species belonging to Mexico and Central America, with two or three species extending into the isthmian part of Colombia and possibly one or two reaching extreme southern Texas. I regret that I have not been able to examine gravid females of any of the species, but I am fully convinced that while the group has some characters allying it to *Unio*, such as the biangulation of the posterior end, there generally being a distinct, double posterior ridge, and the arcuation of many old male shells, yet it is most closely related to *Lampsilis*.

I have been fortunate enough to examine shells of nearly all the species and these with the figures of Sowerby, Kuster, Fischer and Crosse and von Martens have shown me that in nearly every species the shells are distinctly *dimorphic*. That of the male is either incurved, straight, or very slightly rounded out on the base with the angle of the lower posterior ridge on the base line, while that of the female has a more or less decided marsupial swelling, is never arcuate, and has the lower point of the posterior ridge *above the base line*.

It seems to me that all the authors, who have written on the Naiades of this region have either totally failed to note that a majority of them have shells of two forms or have not given the fact sufficient weight, and in several cases the male shell has received one name and the female another—as is the case in *Lampsilis* and *Truncilla*. In some of the species, notably *U. gundlachi* and *medellinus*, the marsupial swelling

of the female is as greatly developed as in any species of *Lampsilis*. In a few instances where I have been able to examine only a single form of a species I could not be positive whether it should be placed here or in *Unio*. The whole group is a difficult one and I have found great variation of specimens among the species and comparatively few shells that at all perfectly agree with the published figures or descriptions.

Group of *Nephronaias medellina*.

Shell scarcely sulcate, shining, rather brightly rayed, distinctly biangulate behind, solid, swollen; beaks rather full, with delicate sculpture; pseudocardinals solid, stumpy, trigonal; laterals heavy, somewhat club-shaped; nacre rich and soft, silvery or purple; female shell considerably inflated at the post-basal region, and differing somewhat from that of the male.

NEPHRONAIAS MEDELLINA (Lea).

Shell long-rhomboid, solid, subinflated, with a rather high, rounded posterior ridge, which is slightly double below and ends in a wide subtruncation; posterior slope obliquely truncate; beaks only moderately full and high, their sculpture not observed; posterior slope often having slight plications or corrugations, the rest of the shell nearly smooth. Surface greenish, darker above, with faint, somewhat wavy, wide or narrow rays; left valve with two strong, ragged pseudocardinals and one strong lateral; right valve with one pseudocardinal and a small tooth in front of and another behind it, and one lateral: sometimes the laterals are more or less subdivided; beak cavities shallow; muscle scars smooth, not deep; nacre purple, reddish or salmon. The female shell is somewhat inflated at the post-basal part; the male shell is slightly arcuate.

Length 70, height 39, diam. 25 mm.

State of Vera Cruz, Mexico.

? Unio purpuriatus SAY, New Harm. Diss., (newspaper form), January 15, 1831.

Unio medellinus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 39, pl. XII, fig. 34; Obs., II, 1838, p. 39, pl. XII, fig. 34.—HANLEY, Biv. Shells, 1843, p. 193, pl. XXI, fig. 19; pl. XXIII, fig. 8.—CHENU, Ill. Conch., 1858, pl. XVII, figs. 6, 6*a*, 6*b*.—KUSTER, Conch. Cab., 1861, p. 162, pl. XLVI, fig. 5.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIII, fig. 171.—von MARTENS, Biol. Cent. Amer., Moll., 1901, p. 517, pl. XXXIX, figs. 7-7*b*.

Margarita (Unio) medellinus, LEA, Syn., 1836, p. 26; 1838, p. 19.

Margaron (Unio) medellinus LEA, Syn., 1852, p. 29; 1870, p. 45.

Nephronias medellinus SIMPSON, Syn., 1900, p. 592.

Unio strebeli LEA, Pr. Ac. N. Sci. Phila., X, 1866, p. 133; Jl. Ac. N. Sci. Phila., VI, 1868, p. 318, pl. LI, fig. 131; Obs., XII, 1869, p. 78, pl. LI, fig. 131.

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

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

Unio aztecorum strebeli VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 503, pl. XXXVII, figs. 1-2*a*.

The type of *Unio medellinus* is a female shell, most decidedly produced at the posterior base, and having the outline and much the appearance of a female *Lampsilis radiata*. The type of *Unio strebeli* from Dr. Strebel is in the National Museum collection and is probably a male, though it is very slightly produced in the post-basal region. With it there is another shell from Dr. Strebel from Vera Cruz, the type locality, which, though younger than the type, has a most decided marsupial swelling.

The *Unio purpuriatus* of Say was believed by Conrad to be the same as Lea's *medellinus*, but Fischer and Crosse in the Mission Scientifique doubt it. As Say never figured his species and as his type is not known to be in existence, I think it is best to use Lea's name.

Pilsbry, (l. c.), considers the *strebeli* of Lea specifically distinct from both *medellina* and *aztecorum*.

NEPHRONAIAS SAPOTALENSIS (Lea).

Shell irregularly long elliptical or slightly rhomboid, solid, inflated, the diameter being greatest one-third of the way from the posterior end; beaks low, their sculpture eroded in the specimens examined; surface smooth, shining, greenish-yellow with numerous split-up, wavy, elegant rays; left valve with two stumpy pseudocardinals and two strong laterals; right valve with one pseudocardinal and one lateral; beak cavities not deep; anterior scars well marked; posterior scars shallow; nacre brilliant silvery, iridescent behind.

Length 56, height 36, diam. 23 mm.

Sapotal River, Vera Cruz, Mexico.

Unio sapotalensis LEA, Pr. Am. Phil. Soc., II, 1841, p. 30; Tr. Am. Phil. Soc., VIII, 1842, p. 233, pl. XXI, fig. 47; Obs., III, 1842, p. 71, pl. XXI, fig. 47.—CHENU, Ill. Conch., 1858, pl. XXXIII, figs. 4, 4*a*, 4*b*.—SOWERBY, Conch. Icon., XVI, 1868, pl. XLI, fig. 495.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 601, LXVII, figs. 2, 2*a*.

Margaron (Unio) sapotalensis LEA, Syn., 1852, p. 29; 1870, p. 45.

Nephronaias sapotalensis SIMPSON, Syn., 1900, p. 592.

Nephronajas sapotalensis ORTMANN, Ann. Car. Mus., VIII, 1912, p. 326, fig. 21.

I have only seen two shells of this species, both of which are probably females, one being considerably and the other strongly produced at the post-basal region. The species seems to be closely related to *N. medellina*, but is shorter, more inflated, more brilliantly painted, and its greatest diameter is nearer the posterior end than it is in that form.

NEPHRONAIAS COMPUTATA (Crosse and Fischer).

"Shell slightly inequilateral, oval-elliptic, rather thick, heavy, a little inflated; epidermis smooth, shining, yellow, with narrow, greenish rays, slightly separated, but becoming closer posteriorly; anterior margin rounded; posterior margin obliquely subtruncate; basal margin curved, not sinuate; dorsal margin slightly curved before and behind the beaks; beaks

not prominent and much eroded. Nacre white. Hinge heavy. Right valve with two unequal pseudocardinals, (the upper compressed, small; the lower trigonal, thick, grooved), and one lateral comparatively short, slightly curved. Left valve with two pseudocardinals, the anterior oblique, quite thick, projecting, grooved, the posterior large, prominent, grooved and two lamelliform laterals. Cicatrices of the anterior adductor muscles deep, grooved; those of the posterior adductors superficial. Ligament brown.

Length 77, height 52, diam. 30 mm." (C. & F.)

Type locality, Goatzalcoalcos, State of Vera Cruz, Mexico.

Unio computatus CROSSE and FISCHER, Jl. de Con., 1893, XLI, p. 295.—FISCHER and CROSSE, Miss. Sci. Mex., Moll., II, 1894, p. 601, pl. LXVII, figs. 2, 2*a*.

"By its ornamentation, *U. computatus* resembles *U. sapotalensis* Lea; but that species, of smaller size, is relatively thicker, more inflated, especially in the middle, and the cardinal tooth in the left valve is very heavy. The shells of *U. computatus* of the same size are thin and the hinge delicate."

This species was accidentally omitted in making up the Synopsis.

Group of *Nephronaias averyi*.

Shell triangular-ovate, bluntly pointed in front and biangulate behind, considerably inflated, irregularly sulcate; umbonal region moderately developed; beaks sculptured with fine, irregular ridges, which have a tendency to fall into two rounded loops; pseudocardinals slightly compressed, ragged; laterals having feeble, oblique striation; front part of the shell somewhat thickened; posterior part thinner; nacre dull, whitish.

Animal unknown.

NEPHRONAIAS AVERYI (Lea).

Shell elliptic rhomboid, inflated, very solid, with a moderate, double posterior ridge ending in a slight biangulation behind, bluntly pointed in front midway up from the base; beaks rather high and full, badly eroded in the only shells seen; surface somewhat concentrically sulcate, scarcely shin-

ing, tawny, rayless; left valve with two heavy, torn pseudocardinals, the posterior one more or less split into denticles behind, and having one strong lateral; right valve with one pseudocardinal, a few denticles behind it and a low, wide lateral; beak cavities moderate; muscle scars impressed, the anterior ones rough; nacre buff-colored. The pallial line has faint radial pittings.

Length 60, height 43, diam. 27 mm.

Isthmus of Darien.

Unio averyi LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 281; Jl. Ac. N. Sci. Phila., IV, 1860, p. 269, pl. XLIV, fig. 149; Obs., VII, 1860, p. 87, pl. XLIV, fig. 149.

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

Nephronaias averyi SIMPSON, Syn., 1900, p. 593.

Both shells in the Lea collection, the only ones I have seen belonging to the species, are probably males and have a straight basal line. There is a faint secondary upper lateral in the left valve. The shell is very solid.

NEPHRONAIAS CALDWELLII (Lea).

Shell irregularly elliptical, subinflated, scarcely subsolid, with a feeble, double posterior ridge; beaks rather full and high, turned forward over a small lunule, their sculpture fine, irregular ridges slightly doubly looped and gradually passing into that on the body of the shell; surface concentrically sculptured; epidermis olive-colored; left valve with two ragged pseudocardinals and two laterals, the upper feeble; right valve with one pseudocardinal and a few denticles behind it, with one lateral; anterior scars rough; nacre bluish, dull colored.

Length 43, height 29, diam. 18 mm.

Isthmus of Darien.

Unio caldwellii LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 118; Jl. Ac. N. Sci. Phila., IV, 1860, p. 265, pl. XLIII, fig. 145; Obs., VII, 1860, p. 83, pl. XLIII, fig. 145.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIX, fig. 477.

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

Nephronaias caldwellii SIMPSON, Syn., 1900, p. 593.

This may be a young *averyi* and it has about the same outlines as that species has at a corresponding size. It is a very much thinner shell and is differently colored within and without. It shows traces of faint, bluish-green rays at the posterior end.

Group of *Nephronaias macnielii*.

Shell solid, slightly sulcate, biangulate behind, covered with a dull, olivaceous epidermis and having faint, bluish-green rays; beaks rather full, sculpture feeble, consisting of slightly outlined ridges, which are somewhat doubly looped, the looped lines becoming swollen or nodulous at their bases; pseudocardinals compressed and ragged; laterals obliquely striated; nacre bluish-white, very soft and brilliant, somewhat iridescent posteriorly; male and female shells differing but slightly. Animal unknown.

NEPHRONAIAS MACNIELII (Lea).

Shell irregularly long elliptical, scarcely subsolid, subcompressed, with a well-developed, double posterior ridge, which ends in a more or less distinctly marked biangulation; beaks moderately elevated but not inflated, turned forward over a small lunule; their sculpture consisting of rather fine, double loops, the loops being but slightly connected together; anterior a little narrowed and rounded; surface irregularly, concentrically striated, brownish or tawny green, sometimes having a few faint, green rays; left valve with two radical pseudocardinals and two laterals; right valve with one pseudocardinal sometimes slightly split into denticles and one lateral; anterior cicatrices impressed; nacre bluish.

The male shell is nearly or quite straight on the base, while that of the female is slightly produced in the post-basal region.

Length 60, height 35, diam. 18 mm.

Nicaragua.

Unio macnielii LEA, Pr. Ac. N. Sci. Phila., XIII, 1869, p. 124; Jl. Ac. Nat. Sci. Phila., 1874, p. 25, pl. VIII, fig. 22; Obs., XIII, 1874, p. 29, pl. VIII, fig. 22.

Nephronaias macnielii SIMPSON, Syn., 1900, p. 593.

Rather compressed and decidedly biangulate behind. The shell is nearly smooth, and sometimes has a slightly silky appearance when fresh.

NEPHRONAIAS OREGONENSIS (Lea).

Shell irregularly obovate or elliptical, subinflated, subsolid, with a moderate posterior ridge; beaks not high or full, their sculpture not observed; surface slightly sulcate, dull yellowish-green with a few faint, rather narrow rays; left valve with two subcompressed, ragged pseudocardinals and two strong laterals; right valve with two pseudocardinals, the upper smaller, the two separated by a parallel sided socket and one lateral; muscle scars well impressed; nacre bluish-white, scarcely shining. The male shell is slightly rounded on the base; that of the female has a decided marsupial swelling. Both shells are feebly biangulate behind, the biangulation in the female being considerably elevated above the base.

Length 55, height 32, diam. 20 mm.

Nicaragua; Guatemala.

Unio oregonensis LEA, Pr. Am. Phil. Soc., V, 1852, p. 252; Tr. Am. Phil. Soc., X, 1852, p. 275, pl. XXII, fig. 33; Obs., V, 1852, p. 31, pl. XXII, fig. 33.—MUSGRAVE, Phot. Conch., 1863, pl. II, fig. 5.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIV, fig. 383.

Margaron (Unio) oregonensis LEA, Syn., 1852, p. 29; 1870, p. 45.

Nephronaias oregonensis SIMPSON, Syn., 1900, p. 594.

Unio radiatulus VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 518, pl. XXXIX, figs. 8, *a*, *b*.

Very closely related to *N. goascoranensis, macnielii,* and *rowellii,* and certain specimens can hardly be assigned to their species. All the specimens I have seen of this species are somewhat rayed, they are not quite so smooth nor so wide behind as *macnielii* nor so inflated as fully adult *rowellii.*

A careful comparison of von Martens' figures and description of his *Unio radiatulus* convinces me that it is the same as Lea's *oregonensis.* There is a considerable number of spec-

mens of this species in the National Museum collection from Nicaragua without specified locality. The type of *oregonensis* is somewhat larger than von Martens' specimen, but there are shells that almost exactly agree with his in size and form. The rays are not shown anything like so clearly in Lea's figure as they should be.

NEPHRONAIAS CHAMPIONI (von Martens).

Shell small, compressed, oblong elliptical, densely inequally striate, subsolid, with a moderate, somewhat double posterior ridge ending in a slight biangulation behind; beaks slightly elevated, placed rather near the anterior end, their sculpture not observed; epidermis fuscous, pale and obscurely radiate in the region of the beaks; pseudocardinals subcompressed; nacre bluish.

The small shell figured is probably a young female, as it is rather full at the post-basal region.

Length 30, height 17, diam. 6.5 mm.

West Guatemala; Paso Antonio, in the Pacific coast region.

Unio championi VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 508, pl. XXXVIII, figs. 9, 9*a*.

I cannot tell much about this species as the description is in Latin and the figure is not very clear. I rather incline to believe it an immature female *Nephronaias,* and it would seem to be near *oregonensis* or *macnielii,* but from the description it appears to be more strongly sulcate than either.

NEPHRONAIAS ROWELLII (Lea).

Shell subtriangular or subelliptical, pointed behind and bluntly pointed in front; dorsal and basal lines curved, the dorsal more strongly so; posterior ridge well developed, rounded or sometimes faintly and narrowly biangulate; beaks rather high, moderately full, their sculpture consisting of fine, doubly looped ridges, which are often slightly nodulous at the bases of the loops; surface somewhat concentrically sulcate; epidermis olive, feebly rayed in the young shells; left valve with

two very ragged, somewhat irregular, subcompressed pseudocardinals and two curved laterals; right valve with one pseudocardinal and a faint tooth above it, with one lateral; beak cavities rather deep; muscle scars impressed; nacre bluish-white.

Female shell full at the posterior base and rather blunt behind: that of the male scarcely, if at all, inflated at the posterior base.

Length 75, height 47, diam. 32 mm.

Nicaragua; Guatemala; Chagres River, Colombia.

Unio rowellii LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 153; Jl. Ac. N. Sci. Phila., IV, 1860, p. 256, pl. XL, fig. 136; Obs., VII, p. 74, pl. XL, fig. 136.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVIII, fig. 471.

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

Nephronaias rowellii SIMPSON, Syn., 1900, p. 594.

Rather more inflated and pointed behind than *N. macnielii*, somewhat more inflated and darker colored than *U. goascoranensis*, darker and less rayed than *N. oregonensis*. These four species are very difficult to separate and Dr. Lea had all four of them in his collection labeled *Unio rowellii*.

NEPHRONAIAS HJALMARSONI (Dunker).

Shell small, irregularly long elliptical, moderately compressed, narrowed and rounded in front, rather wider and subtruncate above at the posterior end; posterior ridge strong, scarcely double, ending in a blunt point near the base line of the shell; beaks but little elevated, about one-third of the way back from the anterior end; base rounded; surface covered with strong, concentric, sometimes anastomosing plaits; epidermis dirty yellow; pseudocardinals somewhat thick, oblique, deeply furrowed but not crenulated; nacre bluish-white.

Length 36, height 18.5, diam. 11 mm.

Rio Chamelicon, Honduras, near Guatemala.

Unio hjalmarsoni DUNKER, Mal. Blätt, V, 1858, p. 227.—VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 509, pl. XXXVIII, figs. 11, 11*a*.

Von Martens figures for the first time this hitherto almost unknown species. I scarcely know where to place it, as it does not have any very decided characters. It may be a male shell, not quite mature, of the genus *Nephronaias,* or it is possibly a *Unio* and related to *U. aratus,* though the form is quite different.

NEPHRONAIAS GOASCORANENSIS (Lea).

Shell elongated, scarcely inflated, subelliptical to subtriangular; dorsal line curved gradually at the hinge and more sharply behind; base line nearly straight in the male, curved outward at the posterior base in the female shell; posterior ridge low, somewhat double; beaks full, moderately high, their sculpture consisting apparently of nearly concentric, fine ridges; epidermis smoky-olive in the younger shells, dirty brownish in old shells, slightly sulcate, rather smooth in young shells, scarcely rayed even when young; left valve with two small pseudocardinals, and two curved laterals; right valve with one pseudocardinal with a very small tooth above and one lateral; muscle scars well impressed, the anterior rough.

Length 60, height 33, diam. 20 mm.

Goascoran River, Honduras; Tehuantepec; Chiapas, Mexico; W. Guatemala; Estero Real, Nicaragua.

Unio goascoranensis LEA, Pr. Ac. N. Sci., Phila., II, 1858, p. 118; Jl. Ac. N. Sci. Phila., IV, 1860, p. 258, pl. XLI, fig. 139; Obs., VII, 1860, p. 76, pl. XLI, fig. 139.—VON MARTENS, Biol., Cent. Am., Moll., 1900, p. 501, pl. XXXVIII, figs. 10, 10*a*.

Margaron (Unio) goascoranensis LEA, Syn., 1870, p. 45.

Nephronaias goascoranensis SIMPSON, Syn., 1900, p. 594.

Unio guatemalanus VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 519, pl. XXXVIII, figs. 7-8*a*.

It is extremely difficult to state the differences between this form and some of the near related species. The young are more delicate and smoother than those of *rowellii* and at all stages it is less inflated and more blunt behind than that species.

After carefully comparing von Martens' description and figures of his *Unio guatemalanus* with numerous specimens from various localities I am satisfied that it is this species. Lea's shells (which he has labeled *Unio roxellii*) from Nicaragua, agree very well with von Martens' description, and they certainly are Lea's *goascoranensis*.

NEPHRONAIAS DYSONII (Lea).

Shell solid, elliptical, scarcely inflated, strongly and regularly sulcate, subbiangular behind, with one or two somewhat angular posterior ridges, the lower the stronger; beaks slightly prominent; ligament light brown; epidermis straw-colored or tawny with one or two darker rays on the posterior slope along as many slight, radial impressions; left valve with two subcompressed, ragged pseudocardinals, with often a third smaller one between them, and two curved laterals, the upper the smaller; right valve with two pseudocardinals, the upper much compressed, and one lateral; muscle scars impressed; dorsal scars on the under side of the hinge plate and the posterior base of the hinder pseudocardinal; beak cavities not deep; nacre white, rather silvery.

Male shell slightly and evenly curved on the base, the posterior end a little elevated. Female shell with a moderate postbasal inflation, the posterior end of the shell higher than in the male.

Length 50, height 32, diam. 17 mm.

Honduras; Costa Rica.

Unio dysonii LEA, Pr. Ac. N. Sci. Phila., XI, 1859, p. 152; Jl. Ac. N. Sci. Phila., IV, 1860, p. 252. pl. XXXIX, fig. 132; Obs., VII, 1860, p. 70, pl. XXXIX, big. 132.

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

Nephronaias dysonii SIMPSON, Syn., 1900, p. 594.

The type is not in the Lea collection, but belonged to Cuming, and is apparently a young female shell. There are several shells in the National Museum collection from San Carlos, Costa Rica, which agree so closely with Lea's description and

figures, that I can have but little doubt that they are his species. They are a trifle narrower behind than the type and the epidermis is darker in the vicinity of the beaks. The shell is occasionally faintly rayed.

NEPHRONAIAS FLUCKI Bartsch.

"Shell elliptical, moderately inflated, attenuated posterioventrally; sloping gently and evenly dorsally from a line extending from the umbones to the posterior ventral angle. Dorsal line evenly arcuate, curving a little more abruptly anteriorly than at the posterior end; ventral margin almost straight or slightly concave. In some, presumably the females, the shell is somewhat drawn out ventrally at the posterior margin, and in such the ventral outline necessarily appears more concave. Surface marked by numerous very strong, concentric lines of growth and crinkly, radiating rays, which are more pronounced on the anterior end, gradually fade out from the middle of the shell posteriorly. Periostracum shining, dark brown at the umbones, fading gradually to greenish-yellow at the edge. Umbonal cavity moderately deep. Pseudocardinal of the right valve strong, triangular, deeply notched, (almost bifid, by the deep, vertical ∧-shaped notch in old specimens), with numerous, fine, secondary notchings. Pseudocardinals of the right valve rather slender, finely notched, inclosing a ∧-shaped cusp between them, which corresponds to the ∧-shaped notch in the other valve. Laterals narrow, slightly arcuate and obliquely ridged. Dorsal muscle scars feeble. Nacre bluish-white at the margin, shading to livid-olive dorsally.

Length 64, height 26.7, diam 17.6 mm." (Bartsch).

Type locality, Wounta River, northwest of Kukallaya, Nicaragua.

Nephronaias flucki BARTSCH, Pr. U. S. Nat. Mus., 1906, XXX, p. 393, pl. XXVII, figs. 2, 3; XXVIII, figs. 2, 3; XXIX, figs. 1, 3.

"*N. flucki* can be readily separated from the other *Nephronaias* of the region by its rugose sculpture, in which respect, it resembles *N. dysoni* Lea, from Costa Rica, and by its wavy, radiating lines and the dark nacre."

NEPHRONAIAS TEHUANTEPECENSIS (Crosse and Fischer).

Shell inequilateral, elliptic rhomboid, moderately inflated, solid,, concentrically sulcate; posterior ridge rather prominent and more or less double, ending behind in a slight biangulation; epidermis tawny to brownish-black, rayless; ligament brown; left valve with two solid, radial pseudocardinals and two delicate laterals; right valve with one strong pseudocardinal and an obsolete tooth above it with one strong lateral; muscle scars well impressed; dorsal scars under the hinge plate; nacre white, straw-colored or salmon. Male shell nearly or quite straight on the basal line; female shell with a slight marsupial swelling.

Length 68, height 38, diam. 25 mm.

Length 58, height 33, diam. 22 mm.

San Efigenia, Oaxaca, Mexico; Capunta, Honduras, in the Patook River.

Unio tehuantepecensis CROSSE and FISCHER, J. de Conch., XLI, 1893, p. 296.—FISCHER and CROSSE, Miss Sci., II, 1894, p. 618, pl. LXV, figs. 3, 3*a*, 4.

Nephronaias tehuantepecensis SIMPSON, Syn., 1900, p. 594.

An oblong, sometimes long ovate, shell, which is smoother, more inflated and less biangulate behind than its near ally, *N. copanensis*.

NEPHRONAIAS COPANENSIS (von Martens).

Shell subrhomboid, subinflated, very solid when old, inequilateral, covered with a tawny brown or blackish, rough epidermis, which is generally sulcate; posterior ridge double, the two ridges widely separated, usually angular and distinct and ending behind in a decided biangulation; beaks probably moderately full, but in all the specimens seen very badly eroded away; left valve with two strong, triangular, ragged pseudo-

cardinals with a smaller one between them and two remote laterals, right valve with one strong, ragged pseudocardinal and sometimes a vestigial one above it, with one small lateral; beak cavities shallow with a large number of dorsal scars extending forward under the teeth; muscle scars well impressed; pallial line well marked, sometimes crossed by radiating furrows; nacre bluish-white, white or yellow to bright orange, in one or two shells purplish.

Length 70, height 38, diam. 24 mm.

Length 75, height 41, diam. 25 mm.

Rio Copan, Guatemala (type); Honduras, various localities (Lea collection).

Unio tehuantepecensis var. *copanensis* VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 502, pl. XXXVI, fig. 6, 6*a*.

A considerable number of shells of this form, part of them from the type locality from von Ihering are in the National Museum collection, others are in the Lea collection from Honduras labeled *scamnatus*. This is a stronger, more rude, more arcuate shell than *U. tehuantepecensis* and much more decidedly biangulate behind and I have no hesitation in considering it worthy of specific rank. The Museum shells all agree very well with von Martens' figures and description, but show considerable of variation. All have the nacre thickened in front. I cannot refer any of the shells I have seen from Cuba to this species. One young specimen in the National Museum is slightly inflated in the post-basal region and may be a female

Group of *Nephronaias reticulata*.

Shell evenly elliptical, slightly biangulate behind, solid and inflated; surface covered with fine, concentric ridges and having delicate radiating furrows, which cut the sulcations and form them into loops.

NEPHRONAIAS RETICULATA Simpson.

Shell evenly long elliptical, subinflated, rather solid, with a low, somewhat double posterior ridge, which ends in a scarcely perceptible biangulation behind; beaks but slightly elevated,

much eroded in the only specimens seen; ligament very pale brown or tawny; surface generally slightly sulcate; epidermis tawny, rayless, with impressed or elevated radiating lines, between which it is looped and wrinkled like dried paint; left valve with two small, stumpy, radiating pseudocardinals and two curved laterals; right valve with one solid pseudocardinal, a small, compressed tooth above it and one lateral; muscle scars impressed, the anterior ones roughened; pallial line distinct, marked with radiating sculpture; nacre soiled white, lurid in the cavity of the shell; dorsal scars numerous, placed under the hinge plate.

Length 50, height 32, diam. 20 mm.

Patook River, Honduras; Rio del Miro, Nicaragua.

Nephronaias reticulatus SIMPSON, Pr. Ac. Sci. Phila., 1900, p. 77, pl. 11, fig. 3; Syn., 1900, p. 595.

The only specimens seen by the writer seem to differ from all related species in having an almost evenly elliptical form. The posterior end of the shell shows a narrow, scarcely perceptible biangulation and the anterior end is narrowed into a rounded point. It is also remarkable for the peculiar epidermal sculpture, much like that of *Plagiola encarpus*. The only two shells I have seen are probably females.

Group of *Nephronaias aztecorum*.

Shell oblong, solid, incurved on the base, having the greatest diameter at or behind the middle; beaks full; pseudocardinals small; epidermis brown, sometimes faintly rayed; female shell with a well-developed marsupial swelling. Animal unknown.

NEPHRONAIAS AZTECORUM (Philippi).

Shell oblong, inequilateral, slightly inflated, the greatest diameter being at or behind the center, varying from subsolid to solid, rounded in front, arcuate at the base; beaks rather high but generally subcompressed; epidermis brown, sometimes feebly rayed; pseudocardinals small; laterals curved; nacre white or purple.

Male shell either rounded or broadly subbiangulate behind, often obliquely subtruncate above, arcuate below. Female shell with a well-developed marsupial swelling, the posterior point much more elevated than it is in the male.

Length 60, height 32, diam. 18 mm.

Length 112, height 56, diam. 42.5 mm.

Mexico.

Unio aztecorum PHILIPPI, Zeits. für Mal., IV, 1847, p. 95; Abbild., III, 1849, p. 109, pl. VI, fig. 2.—KUSTER, Conch. Cab. Unio, 1862, pp. 2, 84, pl. XCV, fig. 6.—VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 502, pls. XXXVI, figs. 2-4, XXXVII, figs. 3, 3*a*, 3*b*.

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

Lampsilis aztecorum SIMPSON, Syn., 1900, p. 572.—PILSBRY, Pr. Ac. N. Sci. Phila., 1909, p. 533.

I am a good deal in doubt as to this species, which I placed in *Lampsilis* in the Synopsis. Philippi's figure is poor and it probably represents a female. Von Martens figures a number of specimens, some of which agree fairly well with Philippi's figure and others differ widely from it. If von Martens is correct the species should go in *Nephronaias,* as the males are arcuate below and sometimes biangulate behind, characters which do not belong to *Lampsilis.* He is mistaken, I believe, in referring the *Unio strebelii Lea* to this species as a variety. I am sure that it is a synonym of *N. medellina. Unio emarginatus* Lea, which he seems to think may be *aztecorum,* is, I am almost sure, a palearctic species.

The larger dimensions given are for one of von Martens' shells.

Var. *chapalanus* von Martens.

"Somewhat higher comparatively, especially in its hinder part; brownish-yellow, with some green rays; ventral margin scarcely concave; cardinal teeth more feeble; inside white.

Length, 60, alt. vert. 31.5, alæ 32, diam. 20 mm. Vertices in ¼ long." (von Martens.)

Type locality, Laguna de Chapala, Central Mexico.

Unio aztecorum var. *chapalanus* VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 504, pl. XXXVI, figs. 5-5*a*.

"From *U. poeyanus*, which belongs also to the Pacific slope of Mexico, this form is distinct by the comparatively higher shell, the height being in *chapalanus* a little more than one-half, in *poeyanus* a little less than two-fifths the length."

NEPHRONAIAS SOLEDADENSIS (Crosse and Fischer).

"Shell inequilateral, elliptic-oblong, elongate, subcompressed, narrowed in front, somewhat expanded posteriorly, rather thick, epidermis olive-brown, concentrically striate; anterior and posterior margins rounded; basal margin nearly straight; dorsal margin slightly curved. Nacre a beautiful purplish-violet. Right valve with two unequal pseudocardinals (the upper obsolete, the lower short, thick, grooved), and a lamelliform lateral. Left valve with two pseudocardinals, the anterior small, short, the posterior larger, grooved and two lamelliform laterals. Cicatrices of the anterior adductor muscles deep, suboval; those of the posterior adductors larger, superficial, suboval. Ligament brownish, not prominent.

Length 67, height 33, diam. 20 mm." (C. & F.)

Type locality, La Soledad, State of Vera Cruz, Mexico.

Unio soledadensis CROSSE and FISCHER, Jl. de Con., 1893, XLI, p. 111.—FISCHER and CROSSE, Miss. Scient. Mex., Moll., 1894, II, p. 608, pl. LXIX, figs. 3, 3*a-b*.

Unio aztecorum var. *soledadensis* VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 503.

"This species appears to belong to the group of *U. aztecorum* Phil., from which it differs by its larger size, more cylindrical and less inequilateral form, its longer and more attenuated anterior extremity and more dilated posterior extremity. It can be distinguished from *U. popei* Lea by its more rounded, non-truncate and less elevated posterior end. Finally, it differs from *U. poeyanus* Lea in its less inequilateral form, the non-concave ventral margin and the posterior extremity being more elevated than the anterior."

Group of *Nephronaias scamnata.*

Shell elliptical to elongate, compressed, strongly sulcate, rather solid, subbiangular behind; that of the female inflated at post-base; epidermis olive to brown, sometimes feebly rayed; beak sculpture delicate and but slightly marked, consisting of faint parallel ridges, which show a tendency to fall into two rounded loops; hinge rather solid; pseudocardinals stumpy, ragged, laterals straight; front part of the shell solid and suddenly becoming thinner behind; nacre bluish-white, salmon, or purple.

Animal unknown.

NEPHRONAIAS SCAMNATA (Morelet).

Shell elongate rhomboid or long elliptical, compressed, inequilateral, subsolid, with a low, generally double posterior ridge ending in a feeble biangulation; beaks not high but sharp, their sculpture consisting of fine, scarcely doubly-looped ridges, which differ little from the close, concentric sculpture that covers the entire shell; ligament long, narrow; epidermis blackish, brownish or olive, sometimes with a few faint, wide rays and occasionally having concentric tawny or light brown bands; left valve with two subtriangular, ragged pseudocardinals and two slender, nearly straight laterals; right valve with one strong pseudocardinal, a vestige of a second above it and one lateral; muscle scars superficial; dorsal scars numerous under the posterior part of the pseudocardinals; nacre reddish or purplish, sometimes nearly white, slightly thicker in front. Male shell straight on the base or a little arcuate; that of the female somewhat produced at the posterior base, the two shells scarcely differing behind.

Length 55, height 30, diam. 15 mm.

Cuba; Honduras?

Unio scamnatus MORELET, Test. Nov., No. 1, 1849, p. 30.

Margaron (Unio) scamnatus LEA, Syn., 1852, p. 40; 1870, p. 35.

Nephronaias scamnatus SIMPSON, Syn., 1900, p. 595.

Unio proclinatus VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 508.

Unio gundlachi SOWERBY, Conch. Icon., XVI, 1866, pl. XLVI, fig. 248.

I am satisfied that there are at least two species of Naiades in Cuba, but it is very difficult without access to the types to say what names should be applied to them. The descriptions of *Unio scamnatus* by Morelet and *U. gundlachi* by Dunker are in Latin and inadequate to satisfactorily characterize these difficult and probably closely related forms. Von Martens, believing that the names of Morelet and Dunker both apply to one species and that there are two diagnosible forms in the island, has applied a new name, *Unio proclinatus,* to the form I have described as *N. scamnata.* Morelet states that the cardinals of his shell are subtriangular, that the epidermis is fulvous-chestnut, and these are two characters, which apply to the species I have described and not to what I incline to believe is Dunker's species, which has a brownish-green epidermis and compressed pseudocardinals. I have examined a large amount of material from Cuba and generally do not have the least trouble in separating the Uniones of that island into the two forms. Usually the species I have described is considerably more elongated than the other, though certain male shells approach closely in form; it is a little less inflated, the outline from a dorsal view showing an even curve from end to end, while that of what I believe to be *gundlachi* is most decidedly swollen at or behind the middle of the skull. *U. scamnata* is more strongly and evenly sulcate, the sculpture covering the entire shell, while in *gundlachi* it is often faint or wanting, especially just in front of the posterior ridge. *N. scamnata* is rayless or has broad, feeble rays; *gundlachi* is almost always rayed. And finally the female shell of *scamnata* appears to be but slightly fuller in the post-basal region than that of the male, while that of *gundlachi* is always well produced, often as decidedly and extensively so as that of *Lampsilis subrostrata.*

I am very doubtful whether this species occurs on the mainland. Lea's specimens from Honduras, which bear that name, are, I think, other species. I have seen specimens credited to Cuba, which approach very closely to *Nephronaias tabascoensis*, but I am not certain that the locality is accurate. I append the original description of *Unio scamnatus*.

"Testa ovata convexo depressa, longitudinaliter tenuissime plicatula, castaneo-fulva, intus cærulescens; umbones depressi, striatim de corticali; dens cardinals in valva dextra simplex, triangularis, in utraque compressus. Alt. 30, Lat. 55, Diam. 17. Cacajajicara, in insula Cuba."

NEPHRONAIS GUNDLACHI (Dunker).

Shell elliptical or elliptic rhomboid, subsolid, subcompressed, somewhat inequilateral; most conspicuously inflated at or just behind the middle, in front of this the outline is wedge-shaped to near the front and where it rather suddenly narrows to the anterior point; posterior ridge scarcely developed, sometimes feebly biangulate, and ending in a faint posterior biangulation; beaks low but sharp, their sculpture fine corrugated ridges, which are doubly looped; surface more or less sculptured with concentric ridges, which are generally less developed in front of the posterior ridge; epidermis smoky-olive to greenish-yellow, generally with more or less distinctly developed green rays; left valve with two subcompressed pseudocardinals and two delicate, nearly or quite straight, laterals; right valve with one subcompressed pseudocardinal, a vestigial one above, and one lateral; muscle scars rather shallow; dorsal scars under the hinge plate and pseudocardinals. Nacre whitish, distinctly and often strongly tinted with blue, slightly iridescent behind.

The male shells are often nearly evenly elliptical, and sometimes the length is only about one and a half times the width. They are nearly straight, rarely somewhat curved below. The female shell is wider behind than in front and has a wide, rounded, often greatly developed marsupial swelling. Its pos-

terior point is high up on the shell; it is sharper than that of the male and occurs at the end of a dark ray.

Length (very large male) 92, height 50, diam. 30 mm.

Length (male) 62, height 35, diam. 18 mm.

Length (female) 65, height 40, diam. 23 mm.

Cuba.

Unio gundlachi DUNKER, Mal. Blätt., V, 1858, p. 228.

Nephronaias gundlachi SIMPSON, Syn., 1900, p. 595.

Unio scamnatus VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 507.

The original description is as follows: "U. testa ovata, paullo compressa, sulcis striisque subtilibus concentricis instructa, epidermide tenui fusca, in speciminibus junioribus olivacea, vestita; umbonibus parum prominentibus decorticalis quartam paene testæ partem occupantibus; margine dorsali leviter curvato, basali plus minusve ventroso; extremitate antica attenuata et rotundata, postica dilatata; dentibus cardinalibus crassiusculis, lateralibus augustis; margarita flavescente vel cœrulescente, posticum versus marginem flavescente. Flumine Taco Taco. Cuba."

The statements that this species is only slightly compressed, the dorsal margin is lightly curved, the basal inflated, the anterior end narrowed and rounded, the posterior dilated, all apply to the shorter, less compressed, paler colored, smoother species, in which the female shell has a most decided marsupial swelling, and they do not apply to what I believe is the *Unio scamnatus* of Morelet. I have before me a female specimen of what I believe is *gundlachi*, which is as decidedly swollen at the post-basal region as is any member of the genus *Lampsilis*.

NEPHRONAIAS ÆRUGINOSA (Morelet).

Shell inequilateral, subrhomboid, moderately convex, solid, covered with a yellowish-chestnut epidermis, and having slight concentric sculpture; posterior ridge low, somewhat double, and ending behind in a wide, faint biangulation; beaks moderately elevated, smooth, according to the author of the species; left valve with one solid, somewhat ragged pseudocar-

dinal and two laterals; right valve with two pseudocardinals, the upper the smaller, and one lateral; anterior muscle scars oval, deep; posterior scars large, shallow; nacre bluish-white.

Length 52, height 32, diam. 18 mm.

River Michol, at Palenque, State of Chiapas, Mexico.

Unio æruginosus MORELET, Test. Noviss., I, 1849, p. 29.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 596, pl. LXII, figs. 2, 2*a*, 2*b*.

Nephronaias æruginosus SIMPSON, Syn., 1900, p. 595.

The shell figured by Fischer and Crosse is probably a young female. In the Lea collection there are three young shells from Comayaguan, Honduras, labeled *Unio scamnatus* that may belong to this species. They are quite pale colored and though worn, show faint rays.

NEPHRONAIAS YZABALENSIS (Crosse and Fischer).

Shell inequilateral, rhomboid elliptical, somewhat compressed, solid, with a low, double posterior ridge, which ends in a distinct biangulation behind; surface covered with concentric striæ, slightly lamellated; epidermis brown-olive with straight, green rays on the posterior slope; beaks small, not very prominent, their sculpture consisting of concentric ridges; left valve with one large, ragged pseudocardinal and a triangular pseudocardinal, with two laterals; right valve with two compressed pseudocardinals, the upper the smaller, and one lateral; anterior muscle scars deep; posterior scars shallow; nacre bluish-white. The shell figured is no doubt a female, the basal line being decidedly rounded and full in the marsupial region; the hinder biangulation is considerably elevated above the base line.

Length 45, height 28, diam. 15.5 mm.

Lake Yzabal, Guatemala.

Unio yzabalensis CROSSE and FISCHER, J. de Conch., XL, 1892, p. 294.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 597, pl. LXIV, figs. 4, 4*a*, 4*b*.—VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 507, pl. XXXIX, figs. 9-11.

Nephronaias yzabalensis SIMPSON, Syn., 1900, p. 596.

I have never seen this species, which seems to be distinguished from other members of its group by being higher in proportion to its length. Von Martens' figures, 10 and 11, represent male specimens. His fig. 9 is probably taken from a young shell.

NEPHRONAIAS RUGULOSA (Charpentier in Kuster).

Shell oblong, rhomboid, compressed or subcompressed, solid, quite inequilateral, covered with close, distinct, concentric furrows; beaks rather high, their sculpture not observed; epidermis olivaceous or greenish-brown, often with hairlike, greenish rays over the disk and one or more broader, distinct green and yellow rays on the posterior slope; pseudocardinals large, solid and ragged; laterals straight; muscle scars well impressed; dorsal scars deep and numerous, extending from the center of the cavity along the base of the pseudocardinals; cavity of the shell shallow; nacre rich purple. The figures of the two shells, which I refer to this species, are evidently taken from male shells and are nearly straight on the base. The lower end of the biangulation behind reaches nearly to the base of the shell.

Length 52, height 28, diam. 14 mm.

Mexico or Central America probably.

Unio rugulosus CHARPENTIER in KUSTER, Conch. Cab. Unio, 1856, p. 154, pl. XLIV, fig. 5.

Nephronaias rugulosus SIMPSON, Syn., 1900, p. 596.

The locality, "New Holland," given in Kuster for this species is undoubtedly erroneous. It is evidently Mexican or Central American, and is, no doubt, a male shell of a species of *Nephronaias*. I have not seen authentic specimens of either this or *Unio persulcatus* Lea, but the two are certainly very close to each other.

NEPHRONAIAS PERSULCATA (Lea).

Shell long rhomboid, rather compressed, subsolid with a low, rounded posterior ridge, which ends in a scarcely perceptable biangulation behind, covered throughout with close, fine,

concentric sulcations; beaks near the anterior end, rather full, their sculpture not observed; anterior and posterior ends rounded below, subtruncate above; base line very slightly rounded; epidermis greenish-brown, with numerous hair-like rays; pseudocardinals large, double in the left valve, considerably split up; laterals long and straight; muscle scars impressed; dorsal scars numerous, deep, extending from the center of the cavity along the base of the pseudocardinals; cavity of the shell very shallow; cavity of the beaks shallow; nacre dark purple, iridescent.

Length 52, height 28, diam. 14 mm.

Mexico.

Unio persulcatus LEA, Pr. Ac. N. Sci. Phila., XI, 1859, p. 153; Jl. Ac. N. Sci. Phila.., IV, 1860, p. 255, pl. XL, fig. 135; Obs., VII, 1860, p. 73, pl. XL, fig. 135.—MUSGRAVE, Phot. Conch., 1863, pl. II, fig. 3.

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

Nephronaias persulcatus SIMPSON, Syn., 1900, p. 596.

Unio cuprinus persulcatus VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 505.

Dr. Lea states that this species has a sharp, compressed keel on the posterior slope, and that there is a single broad yellow ray in this region, extending from the beak to the margin. The outline of the shell is almost exactly like that of Charpentier's *Unio rugulosus,* the only difference being that in Lea's shell the beaks are placed a little farther forward. Charpentier's species has four broad, yellowish bands on the posterior slope, alternating with an equal number of green ones, and has heavy pseudocardinals and shining purple nacre. While I do not feel justified in uniting the two I strongly suspect that they are mere forms of one and the same thing.

NEPHRONAIAS MICRODON (von Martens).

Shell long rhomboid, subsolid, scarcely inflated, with feeble, concentric sculpture; beaks moderately full, their sculpture not observed; epidermis dirty olive to brownish, with feeble rays on some young shells; pseudocardinals small, two in the

left valve and two in the right; two laterals in the left valve and one in the right; pseudocardinals showing a disposition to blend together and become tuberculous in the old shells; anterior scars impressed; posterior scars round, superficial; nacre bluish-white or white.

In the type, an old male shell, the base is almost straight. In three younger shells in the National Museum collection the post-basal region is slightly produced.

Length 107, height 57, diam. 34 mm.

Length 93, height 50, diam. 29 mm.

Guatemala, Rio de las Salinas (Stoll), and Systeme de Polochic (von Ihering).

Unio microdon VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 504. pl. XXXV, figs. 1, 1*a-c*.

I am not positive as to the systematic position of this species as I am not certain that the young, somewhat broken and eroded shells in the National Museum collection are the same as von Martens' species. One of these is as large as *N. calamitarum* and resembles it somewhat, but is much thinner and is evidently a young shell. It appears to show something of the blending together of the pseudocardinals, which is so marked a character in von Martens' shell. A younger fresh valve shows faint rays and a bluish-white nacre.

NEPHRONAIAS CALAMITARUM (Morelet).

Shell very inequilateral, subcompressed, rather solid, somewhat elongated and subrhomboid, with a low, rounded or feebly biangulate posterior ridge; beaks scarcely elevated, compressed but sharp, their sculpture consisting of fine, concentric ridges, which are sometimes feebly corrugated and doubly looped, this sculpture gradually passing into the fine, concentric ridges that cover the surface of the shell; there is often a radiating groove on the posterior slope and this is sometimes replaced by a feeble, dark ray; there are occasionally a few faint rays behind on the younger shells, otherwise the surface is yellowish-green in the young and darker in the old specimens; left valve with two triangular, radial, some-

what split or roughened pseudocardinals and two straight or slightly curved laterals; right valve with one pseudocardinal and sometimes a vestigial one above it with one lateral; there are often indications of a low tooth between the two sets; beak cavities compressed, with several dorsal scars; muscle scars well impressed, the anterior ones rough; nacre whitish, rose or faint purple, scarcely thickened in front and showing a feeble, radiating groove below the laterals. Male shell with a straight or arcuate base line; that of the female a little produced at the posterior base.

Length 50, height 26, diam. 14 mm.

Mexico, Palenque, in the State of Chiapas.

Unio calamitarum MORELET, Test. Noviss., I, 1849, p. 30.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 612, pl. LXIII, figs. 5, 5*a*.

Margaron (Unio) calimatorum LEA, Syn., 1870, p. 63.

Nephronaias calimatarum SIMPSON, Syn., 1900, p. 596.

Unio cuprinus VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 505.

According to Fischer and Crosse in the Mission Scientifique the figure given by Sowerby is not typical, but a variety which they call *nephritica*. Certainly this figure does not closely agree with either their description or figures, and it looks to me like that of a different species. Specimens in the National Museum from Palenque in Chiapas, Mexico, Morelet's locality for this species, agree with the description of Fischer and Crosse and their figure of what they call var. *prolongata*. By an oversight the name was misspelled in the Synopsis.

Var. *arcuans* (Fischer and Crosse).

Shell relatively short, oval, subtriangular; posterior end attenuated; dorsal border arcuated.

Length 47, height 27.5, diam. 17 mm.

Unio calamitarum var. *arcuans* FISCHER and CROSSE, Miss. Sci., II, 1894, p. 613, pl. LXIV, figs. 5, 5*a*.

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

I have never seen this variety, which seems to be shorter than the type, and according to the figures, more distinctly biangulate behind.

Var. *nephritica* (Fischer and Crosse).

Shell subrhomboid, somewhat arcuate, the base line being incurved, scarcely biangulate behind, the almost rounded, low, posterior ridge ending at the level of the base.

? Unio calamitarum Sowerby, Conch. Icon., XVI, 1868, pl. LXXIV, fig. 385.

Unio calamitarum var. *nephritica* Fischer and Crosse, Miss. Sci., II, 1894, p. 613.

Unio cuprinus var. *nephriticus* von Martens, Biol. Cent. Amer., Moll., 1900, p. 505.

It is quite probable that this is the male shell and that var. *arcuans* is the female of one and the same thing, though this form is much less biangulate behind. If this should be the case the name *arcuans* would take precedence.

Var. *subventralis* (von Martens).

"Ventral margin distinctly convex.

Long. 55, alt. vert. 29, alæ 29, diam. 18 mm. Vertices in 3/10 long." (von Martens.)

Type locality, Mexico.

Unio cuprinus var. *subventralis* von Martens, Biol. Cent. Amer., Moll., 1900, p. 506, pl. XXXVI, figs. 1, 1*a*, *b*.

Nephronaias tabascoensis (Charpentier in Kuster).

Shell somewhat elongated, subrhomboid, scarcely inflated, solid, with a low, slightly double posterior ridge, which ends in a feeble biangulation behind; beaks low, placed well forward, their sculpture not observed; surface sculptured with fine concentric sulcations; epidermis dark, rayless; left valve with two strong, radiating, somewhat split-up, pseudocardinals, a rather wide, flat hinge plate, and two laterals, the lower the heavier; right valve with one strong pseudocardinal and one heavy lateral; there are sometimes faint, oblique teeth between them; beak cavities compressed, rather deep, with numerous

dorsal scars; muscle scars well impressed, the anterior ones rough; nacre rich coppery-purple, slightly iridescent behind; pallial line crossed by faint, radiating ridges.

Male shell decidedly long rhomboid, with a straight base line, the lower posterior ridge ending at this line. Female shell slightly obovate, subrhomboid; the base line rounded and somewhat produced behind the middle; lower posterior ridge ending above the base.

Length (male) 58, height 35, diam. 19 mm.

Tabasco, Mexico; small stream near Punta Gorda, Belize, Honduras.

Unio tabascoensis CHARPENTIER in KUSTER, Conch. Cab. Unio, 1856, p. 153, pl. XLIV, fig. 3.

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

Nephronaias tabascoensis SIMPSON, Syn., 1900, p. 596.

Unio cuprinus tabascoensis VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 505.

The shell figured in Kuster is a male and is straight on the base line and has a considerably developed posterior point. Its outline is almost exactly that of the *Unio persulcatus* Lea, and it differs from that species only in having a silvery instead of a purple nacre and in being uniform colored, while *persulcata* has a yellow band reaching from the beaks to the posterior region.

NEPHRONAIAS PLICATULA (Charpentier in Kuster).

Shell elongately obovate, inequilateral, somewhat convex, densely concentrically ridged; beaks longitudinally undulately plicate, rather prominent; epidermis fuscous-olive; pseudocardinals bipartite, solid; laterals rather remote, moderate; nacre beautiful violet, shining.

Mexico, Punta Gorda, Belize; Honduras.

Unio plicatulus CHARPENTIER in KUSTER, Conch. Cab. Unio, 1856, p. 154, pl. XLIV, fig. 4.

Nephronaiias plicatulus SIMPSON, Syn., 1900, p. 597.

The figure in Kuster no doubt represents a female shell, as the base line is rather strongly curved, especially in the region

of the marsupium. There is a shell in the National Museum collection from Belize, which is probably a male of this species, which is a little shorter than Kuster's figure, is more distinctly biangulate behind, and has a nearly straight base line. Another shell in the Lea collection from Honduras I would refer to this. It is a male and has salmon and purple-tinted nacre and seems to stand between *plicatula* and *tabascoensis*. Indeed I think it quite probable that the two species mentioned, Lea's *Unio persulcatus* and Charpentier's *rugulosus* are all forms of one species varying a little in form, color of nacre and epidermis, and in the position of the beaks.

NEPHRONAIAS RAVISTELLA (Morelet).

Shell small, inequilateral, subrhomboid, rather compressed, strongly concentrically striated; beaks apparently low, their sculpture not seen; epidermis brown; left valve with two solid pseudocardinals and two laterals; right valve with two pseudocardinals and a single lateral; anterior muscle scars deep, semicircular; posterior scars suboval, well marked; nacre whitish, tinted lead-color or yellowish-brown.

Fischer and Crosse figure two shells, both badly eroded but apparently having a double posterior ridge, which ends in a distinct, wide biangulation behind. One of these shells is a male and is decidedly arcuate on the base line, the lower part of the biangulation being on the line of the base; the other is probably a female and has the base line curved and full behind the middle, the base of the hinder biangulation being slightly raised.

Length 39, height 21, diam. 13.5 mm.

Guatemala; Tabasco, Mexico.

Unio ravistellus MORELET, Test. Noviss., No. 1, 1849, p. 29.—KUSTER, Conch. Cab. Unio, 1856, pl. XLII, fig. 6.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXII, fig. 366 ?—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 609, pl. LXI, figs. 4, 5, and 5*a*.—VON MARTENS, Biol. Cent. Am., Moll., 1901, p. 516, pl. XXXVIII, figs. 2-6*a*.

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

Nephronaias ravistellus SIMPSON, Syn., 1900, p. 597.

I have never seen the type of this species nor anything more than a single valve of what is probably an authentic specimen, but if Fischer and Crosse's figures are correct I am a little doubtful whether it can equal Sowerby's *Unio vellicatus*, as von Martens believes. The National Museum possesses specimens, which agree almost absolutely with the original figure and description of *vellicatus* and it is a peculiar species. Morelet's species seems to be solider and more decidedly biangulate behind, yet the two forms may run together. Von Martens figures a young female shell with rays. Von Martens makes the *Unio veræ-pacis* of Tristram a variety of the above, and figures it. His figure certainly is the same as that of the *Unio vellicatus* Reeve in the Conchologia. Tristram's description does not seem to me to agree with this, as he says his shell has a shining purple nacre, while that of *vellicata* is dull lurid and ashy-brown.

Var. *majuscula* (von Martens).

"Of larger size; the summits somewhat more advanced.

Long. 59, alt. vert. 27, alæ 28, diam. 17.5 mm.

Long. 58, alt. vert. 26, alæ 27, diam. 17.5 mm.

Long. 55, alt. vert. 26, alæ 27, diam. 20 mm. Vertices in 2/7 long." (von Martens.)

Type locality, Lake of Yzabal, E. Guatemala.

Unio ravistellus var. *majusculus* VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 516.

"The dimensions given above show that this form varies considerably in the general outlines."

NEPHRONAIAS VELLICATA (Reeve).

Shell rather small, long elliptical or long rhomboid, subsolid, somewhat convex, inequilateral, with a well-developed, generally double, posterior ridge; beaks moderately full, their sculpture not seen; surface delicately concentrically ridged; epidermis smoky-brown, rayless in adult specimens; left valve with two subcompressed pseudocardinals and two curved laterals; right valve with one pseudocardinal, often with a second

small one above it, and one lateral; beak cavities shallow; muscle scars not deep, the anterior ones single; nacre whitish or grayish.

Male shell long rhomboid, the base line slightly curved or straight, in old specimens a little incurved; lower posterior ridge ending at the base lines. Female shell decidedly produced in the region of the marsupium, the posterior biangulation elevated above the base line.

Length (male) 43, height 24, diam. 15 mm.

Length (female) 45, height 26.5, diam. 15 mm.

Yzabel, Guatemala.

Unio vellicatus Reeve, Conch. Icon., 1865, pl. xxii, fig. 103.—Fischer and Crosse, Miss. Sci., II, 1894, p. 610.

Nephronaias vellicatus Simpson, Syn., 1900, p. 597.

Unio ravistellus von Martens, Biol. Cent. Am., Moll., 1900, p. 516, pl. xxxviii, fig. 1.

Reeve's figure represents a female shell, which differs a good deal in form from that of the male. Von Martens believes that this equals Morelet's *Unio ravistellus*, but Fischer and Crosse claim that it does not. There are shells in the National Museum, which came from Yzabel, Guatemala, that agree perfectly well with Reeve's figure and description, but are not nearly as heavy nor so widely and distinctly biangulate behind as are the figures given by von Martens. Sowerby's figure of *ravistellus* in the Conchologia may be a young shell of that, but I suspect that it is *vellicata*.

Nephronaias mellea (Lea).

Shell regularly elliptical, scarcely inflated, inequilateral, rather solid, thicker in front, beaks prominent and minutely undulated; surface sulcated throughout; epidermis honey-yellow, bright, obsoletely rayed; posterior ridge rather full and rounded, scarcely double in the specimen figured; pseudocardinals rather large, erect, crenulate, two in each valve, laterals nearly straight, elongated, double in each valve; anterior cicatrices impressed, posterior cicatrices confluent; dorsal cicatrices placed under the hinge plate behind the pseudocardinals;

cavity of beaks deep and angular; nacre salmon-colored, iridescent.

Length 52, height 28, diam. 16 mm.

Mexico or Central America, no doubt.

Unio melleus LEA, Pr. Ac. N. Sci. Phila., XI, 1859, p. 152; Jl. Ac. N. Sci. Phila., IV, 1860, p. 250, pl. XXXVIII, fig. 129; Obs., VII, 1860 p. 68, pl. XXXVIII, fig. 129.— REEVE, Conch. Icon., XVI, 1865, pl. XXI, fig. 92.

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

Nephronaias melleus SIMPSON, Syn., 1900, p. 597.

Dr. Lee states that the type of this species is in the Cunningian cabinet, and there are no specimens in his collection. Judging from the figures and his description I believe it to be a female shell of some species of *Nephronaias* of the *scamnata* group. Lea remarks that it is nearest to his *Unio aratus*. Though the typical *Unio dysonii* is shorter and considerably wider behind than the figure Lea gives of this species, I think it quite likely that the two may run together, as there are shells in the National Museum collection, which are somewhat intermediate.

Genus GLEBULA Conrad, 1853.

Glebula CONRAD, Pr. Ac. N. Sci. Phila., 1853, p. 268.

Shell solid, much inflated, short elliptical, bluntly pointed and slightly biangulate behind, with a low, posterior ridge; female shell swollen at post-base; beaks compressed, destitute of sculpture; epidermis brownish, cloth-like; pseudocardinals divided into irregularly radiating, granular laminæ, sometimes to the number of a dozen or more in each valve; hinge plate reduced to a mere rounded line behind the pseudocardinals; laterals short, remote; anterior adductor scars deep, smooth; there is in each valve only a single, large, semicircular posterior scar with a straight edge in front; dorsal scars numerous, distinct, placed back of the pseudocardinals; cavity of the beaks not deep or compressed; nacre dull lurid to purplish-brown.

Animal with gills nearly equal in size, inner slightly the larger in front, united the whole length to the abdominal sac; marsupium occupying the hinder half of the outer gills; ovi-

sacs separated from each other by a sulcus as in *Lampsilis;* palpi very large, wide, wrinkled; mantle having a wide, slightly thickened border, double edged, the inner being beautifully toothed; branchial opening papillose; anal crenulate; foot small.

Type, *Unio rotundata* Lamarck.

At the time of writing the Synopsis I felt a little doubtful as to the systematic position of this peculiar and isolated form. Recently Mr. Lorraine S. Frierson, who has been making a careful study of the anatomy and shell characters of the Unionidæ of Louisiana has discovered that the beaks of perfect specimens show no sculpture whatever. He has examined gravid specimens and finds that the marsupium occupies the hinder part of the outer gills, much as in *Lampsilis.* On pressure the ovisacs were extruded from the gills, they were flattened in cross section and were about one-half of an inch in length.

The shell of this form is quite different from that of any other I know, seeming to combine some of the characters of *Lampsilis* and some of those of *Quadrula.* It is short, rather inflated, often solid, subtriangular or short elliptical and is often more or less biangulated behind, the latter character rarely being seen in the slightest degree in *Lampsilis.* The pseudocardinals are curiously radically split.

These radial lamellæ are often sharply serrate and they recall the teeth of some of the South American species of *Diplodon.*

It is probable that the apparent radial sculpture shown in eroded specimens in due to a real radiating structure of the shell. This character exists in many Naiades as well as in some of the heavy species of *Venus,* but does not appear unless the shell has begun to disintegrate.

GLEBULA ROTUNDATA (Lamarck).

Shell somewhat elliptical, inflated, rather solid; beaks generally flattened or compressed, though often full in old specimens, without sculpture; posterior ridge moderate, angular and sometimes slightly double; epidermis brownish, cloth-like in

unworn shells, not rayed; left valve with two pseudocardinals, which are often split up into numerous radiating, nodulous lamellæ, with two remote laterals, the lower the larger; right valve with two pseudocardinals, the upper small and compressed, the lower much split up, and one lateral, which is sometimes slightly double; hinge plate narrowed and rounded in front of the laterals; beak cavities moderate, not compressed, showing numerous dorsal scars under the hinge plate; muscle scars large, impressed, smooth, the posterior one semicircular; nacre dull purplish. Female shell slightly inflated at posterior base, sometimes having a slight sinuosity behind the swelling.

Length 95, height 72, diam. 53 mm.

Length 73, height 57, diam. 43 mm.

Length 80, height 54, diam. 32 mm.

Louisiana; eastern Texas; Rio Grande River; Escambia County, Florida.

Type locality, not given.

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

Glebula rotundata CONRAD, Pr. Ac. N. Sci. Phila., 1853, p. 268. —SIMPSON, Syn., 1900, p. 598.

Unio rotundatus HANLEY, Biv. Shells, 1843, p. 201, pl. XXIII, fig. 30.—KUSTER, Conch. Cab. Unio, 1861, p. 256, pl. LXXXVI, fig. 4.—REEVE, Conch. Icon., XVI, 1865, pl. XXIII, fig. 106.—CALL, Tr. Ac. Sci. St. Louis, VII, 1895, p. 47, pl. IX.

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

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

Unio suborbiculata LAMARCK, An. sans Vert., VI, 1819, p. 81.

Unio suborbiculatus FERUSSAC, Guer. Mag., 1835, p. 26.

Unio glebulus SAY, Trans. Jl., IV, 1831, p. 526; Am. Conch., 1832, pl. XXXIV.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 46, pl. XI, fig. 10-12.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIV, fig. 384.

Unio subglobosus LEA, Tr. Am. Phil. Soc., V, 1834, p. 30, pl. II, fig. 3; Obs., I, 1834, p. 142, pl. II, fig. 3.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXIV, fig. 321.

Unio granadensis CONRAD, Pr. Ac. N. Sci. Phila., VII, 1855, p. 256.

A small form of this has been found as far east as Escambia County, Florida. The pseudocardinals are usually split up into radial, nodulous lamellæ and are quite different from those of any North American Naiad I know of.

Conrad says that his *Unio granadensis* is suboval, with the disks somewhat flattened, with minute radiating lines extending to the tips of the beaks. He also states that the nacre of his species is purple. The description therefore fits Lamarck's species perfectly, though I have never known the species to come from so far west as the Rio Grande, Conrad's locality.

Genus OBOVARIA Rafinesque, 1819.

Obovaria RAFINESQUE, J. de Phys. Chim. Hist. Nat., 1819, p. 426.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 320.

Shell short, oval, rounded or retuse, solid, inflated, thick in front, thinner behind, with high beaks, which are sculptured very faint, irregular, often broken and slightly nodulous ridges, which show a tendency to fall into two loops, the posterior often open behind; epidermis dull, brownish, silky, or cloth-like, rarely rayed, rays indistinct; female shell but slightly inflated in the post-basal region, commonly having a shallow furrow or a flattened area at the posterior end; pseudocardinals solid, stumpy; laterals short, club-shaped; anterior and posterior cicatrices deep and distinct; nacre bluish-white or purple.

Animal having the gills very short, the inner united to the abdominal sac throughout; marsupium projecting far below the rest of the branchiæ and occupying the posterior portion of the outer gills, dolabriform or kidney-shaped; mantle with a wide, thickened, double-edged border, the inner edge of which is often slightly toothed at its posterior part.

Type, *Unio retusa* Lamarck.

The genus *Obovaria*, as I have defined it, consists of a few species belonging to the Mississippi and Gulf drainage. The shells are short, rounded or elliptical, solid and inflated

that of the male and female being generally slightly differentiated. The female has a highly organized marsupium much like that of *Lampsilis*. *Unio ellipsis* of Lea and its ally *U. castaneus* differ much in shell characters from the typical Obovarias and form a group that is certainly worthy of subgeneric rank.

KEY TO THE SPECIES OF OBOVARIA.

Shell nearly or quite equilateral.
- Beaks very high and curved forward. *O. retusa.*
- Short, inflated, dull colored, decidedly lighter behind. *O. circulus.*
- Subcompressed to subinflated, smoky, subshining. *O. lens.*
- Rather bright, more or less rayed. *O. unicolor.*
- Small, yellowish, or with a brown flush. *O. leibii.*
- Obovate, small. *O. nux.*
- Nearly orbicular, blackish. *O. rotulata.*

Shell decidedly inequilateral.
- Beaks subterminal, umbonal region inflated.
  - Rather large, not dark colored. *O. ellipsis.*
  - Small, dark colored. *O. castanea.*
- Beaks subcentral, umbonal region subcompressed. *O. jacksoniana.*

Subgenus OBOVARIA s. s.

Shell retrose to short oval; beaks high, central; pseudocardinals rarely parallel with the laterals; cavity of the beaks deep, subcompressed; nacre bluish-white or purple. Animal with the characters of the genus.

OBOVARIA RETUSA (Lamarck).

Shell irregularly quadrate, solid, inflated, with very high beaks, which are turned most decidedly forward over a well-defined lunule; nearly straight or somewhat rounded at the dorsal line, subtruncate behind, curved or nearly straight at the base; posterior ridge rather high and rounded; surface sculptured with low, wide and irregular concentric ridges; epidermis yellowish-brown, somewhat cloth-like in fresh speci-

mens, rayless; left valve with two stout subradial pseudocardinals, with two short, curved laterals, the lower sometimes double; right valve with three pseudocardinals, the middle the larger, the hinder parallel with the somewhat double lateral; hinge plate flat, sharply curved in front of the laterals; beak cavities deep, compressed, the dorsal scars under the pseudocardinals; muscle scars deep, small; nacre coppery-purple, that of the female thickened in front. Female shell with a decided groove behind the posterior ridge, the marsupial area slightly produced.

Length (male) 50, height 50, diam. 32 mm.

Length (female) 47, height 53, diam, diam. 35 mm.

Ohio, Cumberland, and Tennessee River systems.

Type locality, *"les rivieres de la Nouvelle Ecosse."*

Unio retusa LAMARCK, An. sans Vert., VI, 1819, p. 72.

Unio retusus CONRAD, Monog., II, 1836, p. 19, pl. VIII.—REEVE, Conch. Syst., I, 1841, p. 118, pl. LXXXVIII, fig. 16.—HANLEY, Biv. Shells, 1843, p. 202, pl. XXI, fig. 11.—KUSTER, Conch. Cab. Unio, 1852, p. 58, pl. XIII, fig. 2.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXI, fig. 363.— CALL, Tr. Acad. Sci. St. Louis, VII. 1895, p. 45, pl. VIII.

Margarita (Unio) retusus LEA, Syn., 1836, p. 34; 1838, p. 23.

Margaron (Unio) retusus LEA, Syn., 1852, p. 35; 1870, p. 56.

Obovaria retusa SIMPSON, Syn., 1900, p. 599.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 321, fig. 20.

Unio torsus POTIEZ and MICHAUD, Gall. Moll., 1844, p. 149, pl. LVII, figs. 1, 2.

A most remarkable shell, the beaks in old specimens being very high and curved forward like those of an *Isocardia*.

OBOVARIA CIRCULUS (Lea).

Shell variable in outline, subtriangular, rounded or short elliptical, solid, inflated, with high beaks, which are often somewhat turned forward over a moderate lunule, their sculpture consisting of a few rather feeble, slightly doubly-looped ridges; posterior ridge low, rather rounded; surface smooth or having few low, irregular, wide, concentric ridges, covered

with a rayless, dusky brown, often cloth-like epidermis, which is much lighter colored on the posterior slope; left valve with two stout, radial pseudocardinals and two short, nearly straight laterals; right valve with three pseudocardinals, the middle one strong, the hinder faint and sometimes wanting; beak cavities shallow or only moderately deep, compressed; dorsal scars under the pseudocardinals; nacre silvery white, pink, salmon, rich purple.

Length 45, height 47, diam. 30 mm.

Length 48, height 46, diam. 28 mm.

Length 58, height 55, diam. 42 mm.

Ohio, Tennessee and Cumberland River systems; southeast Louisiana and Tombigbee drainage. Reported from Michigan and the St. Lawrence drainage.

Type locality, the Ohio at Cincinnati, the Monongahela at Pittsburgh and the Tennessee at Nashville.

Unio circulus LEA, Tr. Am. Phil. Soc., III, 1829, p. 433. pl. IX, fig. 14; Obs., I, 1834, p. 47, pl. IX, fig. 14.—HANLEY, Biv. Shells, 1843, p. 201, pl. XX, fig. 23.—KUSTER, Conch. Cab. Unio, 1852, p. 41, pl. VIII, fig. 2.—CHENU, Ill. Conch., 1858, pl. XVI, figs. 1, 1*a*, 1*b*.—REEVE, Conch. Icon., XVI, 1865, pl. XXVII, fig. 135.

Margarita (Unio) circulus LEA, Syn., 1836, p. 33; 1838, p. 22.

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

Obovaria circulus SIMPSON, Syn., 1900, p. 600.

Unio subrotundus FERUSSAC, part, Guer. Mag., 1835, p. 28.

Unio subrotundus Raf. v. *circulus* PÆTEL, Conch. Sam., III, 1890, p. 168.

Mya rotunda WOOD, Index Test. (Rev.), 1856, p. 199, pl. I, Supp., fig. 1.

A remarkably variable and unsatisfactory species. Specimens on the one hand almost run into *retusa* and on the other hand there seems to be a more or less complete blending into *lens*. Generally it is smaller and more inflated than the latter species. The epidermis of *circulus* on the body of the shell is dark and absolutely lusterless; that of *lens* is lighter colored and of a more nearly uniform color, and often faintly shining.

The female shell is very little more produced in the marsupial region than the male and the difference between male and female shells in this species is less than in *O. lens*.

OBOVARIA LENS (Lea).

Shell suborbicular, equilateral, subcompressed to subinflated, with rather high, but not inflated, beaks; beak sculpture fine, doubly-looped ridges; posterior ridge rounded; posterior end subtruncate; surface often with a few wide, low, concentric ridges; epidermis brownish, silky, lighter on the posterior slope; left valve with two subradial pseudocardinals, and two laterals; right valve with three pseudocardinals, the middle one largest, and one somewhat double lateral; beak cavities rather deep, compressed; muscle scars small, impressed; nacre white or silvery. The female shell is slightly fuller than the male just behind the center of the base.

Length 50, height 47, diam. 26 mm.

Ohio River Drainage; north to Lake Erie; southern Michigan; south to Columbus, Mississippi.

Type locality, Ohio and Tennessee.

Unio lens LEA, Tr. Am. Phil. Soc. Phila., IV, 1831, p. 80, pl. VIII, fig. 10; Obs., I, 1834, p. 90, pl. VIII, fig. 10.—HANLEY, Biv. Shells, 1843, p. 201, pl. XXI, fig. 4.—CHENU, Ill. Conch., 1856, pl. VIII, figs. 10, 10*a*, 10*b*.—REEVE, Conch. Icon., XVI, 1865, pl. XXVII, fig. 134.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVII, fig. 200.

Margarita (Unio) lens LEA, Syn., 1836, p. 33; 1838, p. 22.

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

Obovaria lens SIMPSON, Syn., 1900, p. 600.

? Unio lævigatus SAY, Am. Conch., VI, 1834.

Var. *depygis* (Conrad).

Shell having the beaks slightly nearer to the posterior end; anterior end somewhat narrowed; posterior end not lighter colored.

Type locality, Harpeth River, Tennessee.

Unio depygis CONRAD, Am. Jl. Conch., II, 1866, p. 107, pl x. fig. 1.

Obovaria lens var. *depygis* SIMPSON, Syn., 1900, p. 601.

Var. *parva* n. v.

Shell very much smaller than the type, varying from subsolid to moderately solid, subinflated to inflated; nacre white or rose-tinted. The female shells are shorter than the males, wider behind, and have a decided post-basal swelling, with a shallow, wide, radial furrow above it.

Length (male) 32, height 25, diam. 15 mm.

Length (female) 29, height 27, diam. 17 mm.

Maumee and Wabash Rivers; Sandusky, Ohio; Tennessee.

This shell has much the same coloring and general form as *O. lens,* but is exceedingly dwarfed. A specimen from the Amite River, Clinton, Louisiana, may possibly be referred to this. It is more inflated and is more regularly rounded than other specimens of the variety. One shell of the variety has pink-tinted nacre.

Var. *elongata* n. v.

There is a form found in the Ohio River, which is more elongated and inflated than the type, and has the beaks nearer to the anterior end, which may bear the above name.

Length, 67, height 53, diam. 35 mm.

This is, if a good species at all, an exceedingly puzzling and variable one. On the one hand it seems to almost insensibly merge into *O. circulus* and by many good conchologists it is thought to equal that species, while on the other it is with difficulty separated from *O. unicolor.* It is usually entirely rayless and is duller colored than the latter. Specimens with a pink or purplish nacre, which I formerly referred to this species are, I believe, *O. unicolor.* The variety *elongata* is distinct enough to be a valid species, but I hardly feel qualified, with the small amount of material I have seen, to give it more than varietal rank. Conrad's *depygis* differs in being inequi-

lateral, with the remarkable character of the beaks nearest the posterior end, that end being the same color as the rest of the shell.

OBOVARIA UNICOLOR (Lea).

Shell short elliptical or ovate, subinflated, rather solid, with a low, but distinctly marked, somewhat rounded posterior ridge; beaks rather full and high, in front of the middle, with feeble, imperfectly looped ridges; surface nearly smooth, somewhat sulcate on the anterior end; epidermis yellowish-brown or brownish, shining, often distinctly, though not brilliantly rayed, in the young shell greenish, lighter in front and having green rays; left valve with two radial pseudocardinals and two curved laterals; right valve with three pseudocardinals, the central one much the larger, and a somewhat double lateral; beak cavities not deep, rather compressed; muscle scars small impressed; nacre usually pinkish, but sometimes white or bluish.

Length 50, height 43, diam. 26 mm.

Mississippi and Alabama, in streams flowing into the Gulf. Type locality, Tuscaloosa, Ala.

Unio unicolor LEA, Pr. Am. Phil. Soc., IV, 1845, p. 163; Tr. Am. Phil. Soc., X, 1848, p. 74, pl. IV, fig. 12; Obs., IV, 1848, p. 48, pl. IV, fig. 12.

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

Obovaria unicolor SIMPSON, Syn., 1900, p. 601.

Unio tinkeri B. H. WRIGHT, Nautilus, XIII, 1899, p. 7.

Obovaria tinkeri SIMPSON, Pr. Acad. Nat. Sci. Phila., 1900, p. 78, pl. IV, fig. 3; Syn., 1900, p. 600.

The type of this species, which is a young female, is somewhat broken and there is another shell in Lea's collection from Jackson, Mississippi, which he has called *Unio lens*, that is a young male. The name *unicolor* is rather infelicitous, as it is the only rayed species in the group. These rays and its generally bright color are the best characters by which to distinguish it from allied species. The female shell is a little more inflated at the posterior base than that of the male. I have seen speci-

mens of what I believe to be genuine *O. lens* from Columbus, Mississippi. After carefully comparing the *Unio tinkeri* B. H. Wright with numerous specimens of *unicolor*, I am forced to the conclusion that the two are practically the same. I have recently had an opportunity of examining quite a good series of these shells.

OBOVARIA LEIBII (Lea).

Shell small, only moderately solid, inflated, oval or short elliptical; beaks rather full in front of the middle, their sculpture not seen; posterior ridge low, somewhat rounded; surface with low, irregular concentric ridges; epidermis generally yellowish or dirty yellowish-green, sometimes of a uniform brownish color in the lighter specimens, not so dark behind in the brown shells; left valve with two small, subtriangular pseudocardinals and two laterals; right valve generally with three pseudocardinals, the middle one only prominent and one lateral; beak cavities not deep; muscle scars shallow; nacre whitish. The female shell is produced somewhat at the post-base, and above and behind the swelling there is often a shallow, wide, radial furrow such as is seen occasionally in the allied species.

Length 35, height 22, diam. 18 mm.

Length 32, height 29, diam. 20 mm.

Length 28, height 24, diam. 18 mm.

Lake Erie and streams falling into it; southern Michigan. Type locality, Erie County, Michigan.

Unio leibii LEA, Proc. Acad. Nat. Sci. Phila., VI, 1862, p. 168; Jl. Ac. N. Sci. Phila., VI, 1866, p. 44, pl. XV, fig. 42; Obs., XI, 1867, p. 48, pl. XV, fig. 42.

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

Obovaria leibii SIMPSON, Syn., 1900, p. 601.

I am inclined now to believe this is a valid species, certainly as good as most of those of this puzzling group. It is always small and longer than high, it is comparatively thin, and its female shells are more produced in the marsupial region than those of *O. circulus*. The specimen from the Sequatchee River, Tennessee, and others that I have seen from Tennessee

since writing the Synopsis are probably not this, but more likely the dwarf form of *O. lens* that I have called var. *parva*.

OBAVARIA NUX n. s.

Shell rather small, greatly inflated, obovate, solid, considerably narrowed and rounded in front, wider and subtruncate behind; beaks no doubt full and high, but greatly eroded in the only shells seen, placed well towards the anterior end; posterior ridge moderate and above it is a shallow, wide radial depression; base line rounded, quite full behind the middle; surface with a few feeble ridges, otherwise smooth; epidermis a rich chestnut, very much lighter colored posteriorly and at the base of the shell; left valve with two triangular pseudocardinals and two remote, short, curved laterals, the high arched hinge line narrowed and rounded between the two sets of teeth; right valve with one strong pseudocardinal, a vestigial tooth each side of it and one somewhat double lateral; beak cavities rather shallow; dorsal scars showing in a row under the pseudocardinals; muscle scars small, impressed; nacre whitish. The only specimens seen probably females, having a sulcus behind, such as is found in *O. leibii*, and a rather full marsupial region.

Length 40, height 30, diam. 25 mm.

Tombigbee River, Moscow, Ala; Cannisaria Lake, Louisiana.

I am exceedingly loath to name a species in this especially difficult group from a couple of specimens, yet the shells I have described will not fit anywhere. The species is perhaps nearest to *O. leibii*, but it is solider, darker and smoother than that. The smaller of the two shells before me, from Cannisaria Lake, Louisiana, is a female and agrees in all essential characters with the larger shell from the Tombigbee River.

OBOVARIA ROTULATA (B. H. Wright).

Shell almost circular in outline, solid, inflated, probably having high beaks, which are badly and deeply eroded in the type, with a faint, curved posterior ridge and a small, somewhat

cordlike ridge above it; surface with a few, low, concentric ridges, otherwise nearly smooth; epidermis deep brown, nearly black, a little lighter colored at the anterior end; left valve with two low, broad, not very perfect, pseudocardinals and two short, curved laterals; right valve with one pseudocardinal, a feeble tooth above, and a wide roughened area behind it, with one somewhat double lateral; beak cavities very deep, compressed; anterior muscle scars roughened; nacre dirty white, slightly iridescent behind.

Length 49, height to top of eroded beaks 45, diam. 30 mm.

Type locality, Escambia River, Escambia County, Florida.

Unio rotulatus B. H. Wright, Naut., XIII, 1899, p. 22.

Obovaria rotulata Simpson, Pr. Ac. N. Sci. Phila., 1900, p. 78, pl. IV, fig. 2; Syn., 1900, p. 601.

I have only seen a single specimen of this, the type, which seems to be one of the best marked species of the genus. Its color pattern is quite different from that of *circulus* and allied forms, and its low, irregular, broad pseudocardinals and the remarkably deep, compressed beak cavities serve to distinguish it.

Subgenus Pseudoön Simpson, 1900.

Pseudoön Simpson, Syn., 1900, p. 601.

Shell elliptical, inflated, solid, that of the males slightly pointed at the upper posterior part; epidermis brownish or blackish, rayless or very feebly rayed; beaks anterior; pseudocardinals solid, stumpy, or slightly elongate in age, and showing a tendency toward being parallel with the laterals; cicatrices deep; nacre silvery, iridescent posteriorly.

Animal having a mantle with a wide, thickened, double border, the inner edge being toothed throughout below; gills small; marsupium not reaching to the posterior end of outer branchiæ, though extending quite well forward; ovisacs rather numerous, large and distinct, tinted with purple below; anal and branchial openings finely toothed.

Type, *Unio ellipsis* Lea.

OBOVARIA ELLIPSIS (Lea).

Shell usually evenly elliptical, sometimes rather ovate, inflated, solid, with high beaks placed close to the anterior end and turned forward over a small lunule, their sculpture consisting of a few somewhat doubly looped bars; posterior ridge scarcely developed; anterior end rounded or subtruncate; surface nearly smooth or having a few shallow, irregular sulcations; epidermis greenish or yellowish-brown, with faint, darker rays; left valve with two pseudocardinals, the posterior one nearly parallel with the stout, curved laterals; right valve usually with three pseudocardinals, the two outer ones small, the middle and upper ones in all shells parallel with the strong double lateral; beak cavities shallow, showing a row of dorsal scars; muscle scars small, impressed, the anterior ones rough; nacre silvery white, much thickened in front. The shells of the male and female differ but little, those of the latter being a very little more produced at the post-basal part than the former.

Length 75, height 56, diam. 45 mm.

Length 63, height 47, diam. 35 mm.

Upper Mississippi system as far south as the Tennessee and Arkansas Rivers; St. Lawrence drainage area.

Type locality, Ohio.

? Unio brevialis SOWERBY, Rec. and Foss. Shells, XVI, 1823, fig.

Unio ellipsis LEA, Tr. Am. Phil. Soc., III, 1828, p. 268, pl. IV, fig. 4; Obs., I, 1834, p. 10, pl. IV, fig. 4.—SAY, Am. Conch., I, 1831, pl. XIV.—HANLEY, Biv. Shells, 1843, p. 188, pl. XXI, fig. 7.—POTIEZ and MICHAUD, Gall. Moll., 1844, p. 150, pl. LVIII, figs. 1, 2.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 22, pl. IV, figs. 1, 1*a*, 1*b*.—KUSTER, Conch. Cab. Unio, 1852, p. 43, pl. VIII, fig. 4.—CHENU, Ill. Conch., 1858, pl. XVIII, figs. 1, 1*a*, 1*b*.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXX, fig. 424.

Margarita (Unio) ellipsis LEA, Syn., 1836, p. 22; 1838, p. 18.

Margaron (Unio) ellipsis LEA, Syn., 1852, p. 26; 1870, p. 41.

Obovaria ellipsis SIMPSON, Syn., 1900, p. 602.

Unio triangularis SAY, Am. Conch., VI, 1834.

Unio olivarius CONRAD, New F. W. Shells, 1834, p. 70.

Unio taitianus SOWERBY, Conch. Icon., XVI, 1868, pl. LXVII, fig. 338.

Unio pealei LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 191; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 26, pl. VIII, fig. 23; Obs., XIII, 1874, p. 30, pl. VIII, fig. 23.

Unio pealei Lea, of Kansas, is a little lighter colored than the type and has the beaks a little farther from the anterior end, but it does not seem to me to be worthy of even varietal rank.

OBOVARIA CASTANEA (Lea).

Shell rather small, that of the male ovate, that of the female elliptical, inflated, solid, blackish-chestnut or olive-green, sometimes with faint, concentric, lighter and darker bands, occasionally faintly rayed behind; beaks full and high, placed near the anterior end and marked with a few feeble, nearly parallel ridges; posterior ridge low; left valve with two pseudocardinals, the upper running nearly parallel with the two curved laterals; right valve with two pseudocardinals, with rarely a third posterior one, the anterior tooth compressed, and a double lateral; beak cavities shallow; muscle scars small, impressed; nacre whitish or bluish white, iridescent and slightly thinner behind. The male shell is ovate and pointed behind about midway up from the base; the female shell is elliptical, full at the post-base, scarcely pointed behind, and in all cases I have seen is much smaller than that of the male.

Length (male) 40, height 32, diam. 27 mm.

Length (female) 28, height 22, diam. 20 mm.

Streams flowing into the Gulf of Mexico, from the Alabama River west to the Nechez.

Type locality, Alabama River.

Unio castaneus LEA, Tr. Am. Phil. Soc., IV, 1831, p. 91, pl. XI, fig. 21; Obs., I, 1834, p. 101, pl. XI, fig. 21.—HANLEY, Biv. Shells, 1843, p. 188, pl. XXII, fig. 30.—CHENU, Ill. Conch., 1858, pl. XI, figs. 5, 5*a*, 5*b*.

Margarita (Unio) castaneus LEA, Syn., 1836, p. 22; 1838, p. 18.

Margaron (Unio) castaneus LEA. Syn., 1852, p. 26; 1870, p. 41,

Obovaria castanea SIMPSON, Syn., 1900, p. 602.

Much smaller and darker than *ellipsis,* and the difference between male and female shells is much more strongly marked. Some of the male shells approach closely to Lea's *Unio simulans,* but are generally a little heavier and more inflated. In the latter species the male and female shells are essentially alike.

The name *castaneus* was applied to some *Unio,* which I am unable to determine, by Rafinesque in a Continuation of a Monograph on the Bivalve Shells of the River Ohio, etc., in October, 1831. According to Scudder, Lea's name was published the latter part of the same year, but I have no means of knowing which appeared first. Under the circumstances I use Lea's name.

OBOVARIA JACKSONIANA Frierson.

"Shell ovate, smooth, rounded before and below, nearly straight from beak to post-point, which is about half way the height of the shell; umbonal ridge low, and the posterior area very narrow; beaks not high, sculpture not seen; nacre bluish-white, iridescent behind; teeth double in left, single in right valve; cardinals stout, erect; laterals not very large; muscle scars confluent behind, separate before; pallial line obsolete behind.

Length 45, height 33, diam. 20 mm." (Frierson).

Type locality, Pearl River, Mississippi. Also in the Yalabusha River, Mississippi.

Unio (Obovaria) jacksonianus FRIERSON, Naut. XXVI, 1912, p. 23, pl. III, figs. 1, 2, 3.

"The novelty of the present species was determined by gravid specimens collected by Mr. A. A. Hinkley and by a comparison with *castaneus* of the Lea collection by Mr. Bryant

Walker. This species has not the female form of *castaneus*, and the dorsal scars are in the bottom of the beaks in place of being on the teeth.

In outline it is nearly the same as *U. strodeanus* B. H. Wr., but differs in being greenish, while *strodeanus* is dead black; its beak cavities are deeper, and its teeth are much longer, stouter and more erect.

From *U. curtus*, to which it is allied, it differs, lacking the pronounced swelling before.

Many of these shells show a constriction like the *U. constrictus* of Conrad, and it may be that this is a sexual mark."

The following species are unfigured or indeterminable.

Obovaria cordata RAFINESQUE, Ann. Gen. Sci. Brux., V, 1820, p. 312, pl. LXXXII, figs. 6, 7.

Obovaria stegaria RAFINESQUE, Ann. Gen. Sci. Brux., V, 1820, p. 312, pl. LXXXII, figs. 4, 5.

Obovaria striata RAFINESQUE, Ann. Gen. Sci. Brux., V, 1820, p. 311.

Obovaria torsa RAFINESQUE, Ann. Gen. Sci. Brux., V, 1820, p. 312, pl. LXXXII, figs. 1, 3.

Obliquaria retusa RAFINESQUE, Ann. Gen Sci. Brux., V, 1820, p. 306, pl. LXXXI, figs. 19, 20.

Genus PLAGIOLA (Rafinesque, 1819) Agassiz.

Plagiola RAFINESQUE, J. de Phys. Chim. Hist. Nat., 1819, p. 426.—AGASSIZ, Arch. für Nat., 1852, p. 48, redefined.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 329.

Shell triangular ovate, somewhat inflated, solid, with a distinct and often sharp posterior ridge; surface concentrically sculptured; umbonal area somewhat flattened; beaks high but compressed, sculptured with delicate, parallel, doubly-looped ridges, the anterior loop rounded, the posterior angular; pseudocardinals ragged; laterals club-shaped, straight or slightly curved; cavity of the beaks moderate, often somewhat compressed; nacre silvery; female shell more or less inflated at post-basal region.

Animal having the outer gills narrow in front and wide behind; inner gills wide in front, posteriorly free or united to abdominal sac; marsupium occupying the posterior part of the outer gills, but not extending quite to the hinder end, consisting of well-marked ovisacs, which are rounded below; a distinct sulcus extends the whole length of the kidney-shaped marsupium at the inside and outside at some distance above its base; mantle edge thickened and somewhat doubled, in some cases toothed or fringed below.

Type, *Unio securis* Lea.

The genus *Plagiola,* as I have constituted it, contains a small number of North American species having rather short, triangular-ovate shells with high, but mostly compressed, beaks and a strong, usually rather sharp, posterior ridge. In general the female shell has a more or less distinctly developed marsupial swelling. The marsupium is much like that of *Lampsilis* and the higher organized Naiades consisting of distinctly marked ovisacs in the hinder part of the outer gills.

The genus is easily divisible into three well-marked subgenera, the typical *Plagiola* with a heavy shell, with highly painted epidermis and wide hinge plate, the female shell being smaller and more inflated than the male, and having a well-developed marsupial swelling; *Amygdalonaias* with much more delicate, highly pointed shells with a narrow hinge plate, and *Artonaias,* a group of Central American forms, with concentric sculpture and full colored, often wrinkled, epidermis. It may be remarked that occasional specimens in both the first mentioned subgenera are dull colored, destitute of rays and have slightly wrinkled epidermis.

Key to species of Plagiola.

Shell painted with broken rays.
- Heavy, with wide hinge plate. — *P. securis.*
- Subsolid, with narrow hinge plate.
  - Inflated, strongly truncated behind. — *P. elegans.*
  - Moderately inflated, rather solid. — *P. cognata.*
  - Scarcely inflated. — *P. donaciformis.*
  - Compressed. — *P. macrodon.*

Shell dull colored, sulcate.
  Surface radiately grooved.
    Rather solid, tawny or pale brown. *P. cyrenoides.*
    Subsolid, dark colored. *P. imbricata*
  Surface not radiately grooved.
    Very solid, greatly inflated. *P. sallei.*
    Subsolid, moderately inflated. *P. nicaraguensis.*

Subgenus PLAGIOLA s. s.

Shell solid, surface irregularly concentrically ridged; epidermis smoothish, but here and there wrinkled; painted with larger and smaller scattered rays, which are generally broken into irregular lunate or squarish blotches; hinge heavy and strong; hinge plate wide and flat; female shell smaller than the male, more inflated, and swollen at post-basal region.

Animal having the branchiæ rounded below, inner the larger, wholly or partly free from the abdominal sac; marsupium large, projecting far below the inner gills; mantle very thin, dark on its thickened, fringed double edge; anal opening with very small papillæ.

PLAGIOLA SECURIS (Lea).

Shell subtriangular, solid, subcompressed or scarcely inflated, with a sharply defined up-curved posterior ridge, behind which it is truncated; region of the beaks and a considerable area of the upper part of the shell compressed; beak sculpture consisting of a few irregular, slightly doubly-looped ridges; beaks curved forward over a small, wide lunule passing back under the hinge, where it is filled with epidermal matter; ligament small, brown; surface with irregular, often rude, sometimes almost sulcate, growth lines; epidermis rather smooth, but showing fine, wrinkled loops under a glass, tawny or yellowish-green, generally with faint, broken rays, which are made up of dots or lunate or arrow-head markings; they are sometimes composed of alternately lighter and darker dashes; hinge strong, the plate often flattened; left valve with two triangular, ragged pseudocardinals, a faint anterior third

one, and two slightly curved laterals; right valve with three pseudocardinals, the middle one the largest, and two laterals, the lower the smaller; beak cavities moderately deep; muscle scars impressed, the anterior ones ragged; nacre silvery-white The male and female shells differ widely, the former are much the larger and are considerably compressed; the female shell is somewhat humped, is more or less inflated, is considerably produced at the posterior base and gaps a little in front and behind.

Length (male) 90, height 66, diam. 35 mm.

Length (female) 57, height 43, diam. 30 mm.

Mississippi drainage south into Arkansas; west into eastern Iowa and Kansas; Tombigbee and Alabama river systems.

Type locality, Ohio.

Obliquaria (Plagiola) depressa RAFINESQUE, Ann. Gen. Sci. Phys. Brux., 1820, p. 302, pl. XXXI, figs. 5-7.

Unio securis LEA, Tr. Am. Phil. Soc., III, 1829, p. 437, pl. XI, fig. 17; Obs., I, 1834, p. 51, pl. XI, fig. 17.—HANLEY, Biv. Shells, 1843, p. 184, pl. XX, fig. 51.—CHENU, Ill. Conch., 1858, pl. XVI, figs. 4, 4*a*, 4*b*; Man., II, 1859, p. 138, fig. 671. —SOWERBY, Conch. Icon., XVI, 1868, pl. LXI, fig. 304.

Margarita (Unio) securis LEA, Syn., 1836, p. 19; 1838, p. 16.

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

Plagiola securis SMITH, Bull. U. S. Fish Com., 1899, p. 291, pl. LXXX.—SIMPSON, Syn., 1900, p. 603.

Unio lineolata SAY, Am. Conch., VI, 1834.

Plagiola lineolata AGASSIZ, Arch. für Nat., I, 1852, p. 48.

Unio lineolatus CONRAD, New F. W. Shells, 1834, p. 70.—SAY, Am. Conch. (continuation), VII, pl. LXVIII (no date).—KUSTER, Conch. Cab. Unio, 1861, p. 171, pl. LIII, figs. 1, 2.

In some cases the female shell differs so from that of the male that expert students have believed it to be a different species. I have an apparently fully adult female shell before me, which is 40 millimeters long, 36 in height and 25 in diameter. The males appear to be most abundant. Some Coosa River specimens have a rough, rayless epidermis with more or less wrinkled loops. They are destitute of any pattern of

painting and to some extent resemble such Central American specimens as *P. cyrenoides* and *imbricato*.

Rafinesque's name *depressa*, for what is probably a male of this species, has precedence over Lea's name, but it was used previously by Lamarck for an Australian *Unio*. Rafinesque placed this species in his genus *Obliquaria* and the subgenus *Plagiola*, but after giving the name *Obliquaria depressa* he called it *U. depressa* in parenthesis.

Subgenus Amygdalonaias Fischer and Crosse. 1893.

Amygdalonaias Fischer and Crosse, Miss. Scient. Mex., Moll., II, 1893, p. 557.

Amygdalonajas Ortmann, Ann. Car. Mus., VIII, 1912, p. 327.

Shell compressed to inflated, decidedly truncated at the posterior slope; surface slightly concentrically sculptured; posterior ridge sharp and well defined; epidermis shining, sometimes wrinkled, looped and painted with a beautiful pattern of broken or arrow-headed rays; area of the beaks flattened off in the direction of the axis of the shell, but not compressed; beak sculpture delicate, somewhat broken and doubly-looped, the anterior loop rounded, the posterior sharp below, the ribs fading out where they cross the posterior ridge; hinge delicate; pseudocardinals rather compressed, high and ragged; hinge plate narrow; female shell very slightly swollen at post-base.

Animal having the branchiæ more or less free from the abdominal sac; marsupium consisting of numerous distinct ovisacs and having a well-marked sulcus extending around it at some distance above its base; mantle thickened and doubled on its edge, which has dark papillæ.

Type, *Unio cognatus* Lea.

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

Group of *Plagiola elegans*.

Shell short, triangular oval, inflated with a very sharp posterior ridge extending from the beaks to the hinder point of the shell; male and female shells scarcely distinguishable, both being much expanded in the basal region.

PLAGIOLA ELEGANS (Lea).

Shell subrhomboid, solid, inflated, with a very sharp posterior ridge, behind which it is decidedly truncated; beaks high and full, turned forward over a small lunule; region of the beaks and upper part of the shell decidedly flattened; central base of the shell full; posterior point sharp, elevated considerably above the base; surface with irregular, subsulcate growth lines; epidermis dull or somewhat shining, often having wrinkled loops behind, yellowish-green with numerous wavy, often broken, rays. Sometimes in addition to the rays there are numerous wavy or zigzag lines and occasionally the shell is tawny or reddish and rayless; hinge line curved; pseudocardinals ragged, two in the right valve and one in the left, sometimes they are much split up; left valve with two laterals; right valve with one and sometimes a faint second one below it; beak cavities not deep; muscle scars impressed; nacre bluish-white, white, salmon or reddish. The form of the shell is quite variable and those of the female and male differ but little from each other. The female shell is a little more produced at the central base.

Length (male) 57, height 43, diam 30 mm.

Length (female) 68, height 52, diam. 37 mm.

Mississippi drainage generally; Michigan; Lake Michigan; southwest to Trinity River, Texas.

Type locality, Ohio River.

Unio elegans LEA, Tr. Am. Phil. Soc., IV, 1831, p. 83, pl. IX, fig. 13; Obs., I, 1834, p. 93, pl. IX, fig. 13.— HANLEY, Biv. Shells, 1843, p. 183, pl. XXI, fig. 33.— CHENU, Ill. Conch., 1858, pl. XV, figs. 3, 3*a*, 3*b*; Manual, II, 1859, p. 138, fig. 672. — SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIV, p. 380.

Margarita (Unio) elegans LEA, Syn., 1836, p. 18; 1838, p. 16.

Margaron (Unio) elegans LEA, Syn., 1852, p. 23; 1870, p. 36.

Plagiola elegans BAKER, Moll. Chicago, Pt. 1, 1898, p. 91, pl. XXI, fig. 1.—SIMPSON, Syn., 1900, p. 604.

Amygdalonajas elegans ORTMANN, Ann. Car. Mus., VIII, 1912, p. 328.

Unio truncatus SAY, Am. Conch., VI, 1834; Am. Conch. (continuation), VII, pl. LXVII (no date).—KUSTER, Conch. Cab., 1861, p. 174, pl. IV, figs. 2, 3.

Unio truncatus RAFINESQUE var. *elegans* PETEL, Conch. Sam., III, 1890, p. 170.

Shorter, more inflated and more decidedly truncated behind than *P. donaciformis*, towards which it sometimes varies.

Group of *Plagiola donaciformis*.

Shell small, elongated, triangular oval; posterior ridge generally well defined but rarely sharp, having broken green rays, which form chevrons or blotches on a lighter ground; female shell somewhat inflated in the post-basal region.

PLAGIOLA DONACIFORMIS (Lea).

Shell rather small, subsolid, irregularly ovate, subinflated, inequilateral, with moderately high and full, though slightly flattened, beaks, whose sculpture consists of fine, doubly-looped ridges, the hinder loop being quite irregular on the sharp posterior ridge; surface with irregular growth lines, sometimes slightly plicate or corrugated on the posterior slope, generally shining, pale or yellowish-green with a beautiful pattern of darker green rays. These rays are sometimes entire, but are generally broken up into arrow-head or zigzag markings; left valve with two compressed pseudocardinals and two laterals; right valve with one pseudocardinal and one lateral; beak cavities shallow; muscle scars impressed, the posterior ones round; nacre bluish-white. The female shell is apparently always smaller than that of the male and has a decided marsupial swelling, the sharp posterior point being a little more elevated than that of the male shell.

Length (male) 47, height 32, diam. 20 mm.

Length (male) 37, height 23, diam. 16 mm.

Length (female) 31, height 20, diam. 15 mm.

Mississippi drainage generally; Alabama River area; southwest to the Trinity River, Texas; Michigan.

Type locality, Ohio

Unio donaciformis LEA, Tr. Am. Phil. Soc., III, 1828, p. 267, pl. IV, fig. 3; Obs., I, 1834, p. 9, pl. IV, fig. 3.—HANLEY, Biv. Shells, 1843, p. 183, pl. XXII, fig. 41.— CHENU, Ill. Conch., 1858, pl. XI, figs. 4, 4*a*, 4*b*.

Margarita (Unio) donaciformis LEA, Syn., 1836, p. 18; 1838, p. 16.

Margaron (Unio) donaciformis LEA, Syn., 1852, p. 24; 1870, p. 36.

Plagiola donaciformis BAKER, Moll. Chicago, Pt. 1, 1898, pl. XIII, fig. 4.— SIMPSON, Syn., 1900, p. 605.

Unio zigzag LEA, Tr. Am. Phil. Soc., III, 1829, p. 440, pl. XII, fig. 19; Obs., I, 1834, p. 54, pl. XII, fig. 19.— HANLEY, Biv. Shells, 1843, p. 183, pl. XXII, fig. 42.— KUSTER, Conch. Cab. Unio, 1852, p. 42, pl. VIII, fig. 3.— CHENU, Ill. Conch., 1858, pl. VIII, figs. 8, 8*a*, 8*b*; Man., 1859, II, p. 138, fig. 670.— SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIX, fig. 213.

Margarita (Unio) zigzag LEA, Syn., 1836, p. 18; 1838, p. 16.

Margaron (Unio) zigzag LEA, Syn., 1852, p. 24; 1870, p. 36.

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

Unio nervosus SAY, Am. Conch., VI, 1834.— KUSTER, Conch. Cab. Unio, 1861, p. 175, pl. LV, fig. 4.

A beautiful and variable species, occasionally quite abundant. The pattern of coloring varies greatly, there being occasional shells with unbroken rays, which look like a compressed, drawn-out *elegans*. Rarely the shell is a uniform ashy or dirty yellowish-green as is sometimes the case with that species. It is generally more inflated than *P. macrodon*, but it is quite probable that it gradually merges into that species in the southwest. I collected at one time in southern Kansas and Indian Territory and many specimens found in that region seem to stand between the two forms. A specimen before me from Cincinnati, Ohio, is very much like *P. macrodon*, but has a slightly more distinct color pattern.

PLAGIOLA MACRODON (Lea).

Shell long ovate, subcompressed, subsolid, with scarcely elevated, compressed, flattened beaks, their sculpture consisting of very fine doubly-looped ridges that are sharply angled at

the pinched-up posterior ridge; surface rather smooth, feebly shining, pale dirty or smoky-greenish, with a pattern of broken rays, which are often made up of irregular blotches or zigzag markings; this zigzag pattern is sometimes developed between the rays. Left valve with two compressed pseudocardinals and two laterals; right valve with one pseudocardinal and one lateral; beak cavities very shallow; muscle scars small, the hinder circular; nacre bluish. The female shell is quite full in the post-basal region and much more blunt behind than the male.

Length (male) 45, height 27, diam. 16 mm.

Length (female) 37, height 23, diam. 14 mm.

Eastern Texas, northward probably into Kansas.

Type locality, Rutersville, Texas.

Unio macrodon LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 154; Jl. Ac. N. Sci. Phila., VI, 1862, p. 193, pl. XXVI, fig. 262; Obs., IX, 1863, p. 15, pl. XXVI, fig. 262.—?SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVIII, fig. 437.

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

Plagiola macrodon SIMPSON, Syn., 1900, p. 605.

Less inflated and rather longer than *P. donaciformis,* the color patterns less vivid and generally not quite as sharply pointed behind. The female shell especially is quite blunt.

PLAGIOLA COGNATA (Lea).

Shell elliptical, convex, solid, inequilateral, with a well-developed posterior ridge and high beaks, which are sculptured with a few delicate, doubly-looped bars; epidermis smooth, shining, yellowish-green with a number of darker rays; left valve with two triangular, somewhat ragged, pseudocardinals, the anterior one smaller, and two laterals, the upper the smaller; muscle scars deep; beak cavities moderate and rather shallow, showing the dorsal scars; nacre bluish white or silvery, iridescent and thinner behind.

Length 44, height 28, diam. 20 mm.

Rio Salado, New Leon, Mexico.

Unio cognatus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 306; Jl. Ac. N. Sci. Phila., IV, 1860, p. 368, pl. LXV, fig. 193; Obs., VIII, 1860, p. 50, LXV, fig. 193.— SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIX, fig. 214.

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

Plagiola cognata SIMPSON, Syn., 1900, p. 606.

I have only seen two left valves of this species, one the type, and a young one. Both are quite solid, the younger being perfect enough to show something of the beak sculpture. The older one is probably from a female, as it is rather full in the post-basal region. I should say that the species is closely related to *P. macrodon* and *donaciformis,* but it is a heavier shell than either and more inflated than the former. The younger valve shows a decided, sharp posterior ridge, in front of which, especially near the beak, the surface is decidedly flattened or almost excavated as in *Plagiola elegans.*

Subgenus ARTONAIAS von Martens, 1900.

Artonaias VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 480.

Ptychoderma SIMPSON, Syn., 1900, p. 606.

Shell triangularly ovate or rounded, solid, bluntly angled before, more sharply angular behind, with a tolerably well-marked posterior ridge; surface strongly and irregularly concentrically sulcate; beaks small but rather prominent, sculptured with fine, irregular, broken ridges, which are somewhat doubly looped, the front loop being larger and more rounded; epidermis olive to tawny, wrinkled, sometimes having faint rays; pseudocardinals compressed, ragged; hinge plate narrow; laterals short, slightly curved, obliquely striated; muscle scars rather shallow, the posterior round; female shell produced in the post-basal region.

Animal having the branchiæ small, inner united the whole length to the abdominal sac, wider than the outer in front, narrower behind; marsupium occupying the posterior part of the outer gills in from eleven to twenty distinct ovisacs, which are rounded and dark below, the whole having a distinct, parallel sulcus inside and out near its base; mantle thin, papery,

with a wide, thickened, double edge, which is sometimes crenate; branchial opening large, fringed; anal opening smooth or with only the faintest crenulations.

Type, *Unio cyrenoides* Philippi.

The name *Ptychoderma* was published by me in the Synopsis Oct. 6, 1900; von Martens had published the name *Artonaias* for practically the same group in the Biologia Centrali Americana in February of the same year, but at the time my name went through the press I had not seen it.

Group of *Plagiola cyrenoides*.

Shell generally more or less covered with radiating grooves, which cut up the concentric sculpture into looped wrinkles or nodules, sometimes having the appearance of dried, wrinkled paint, the sculpture extending into the substance of the shell; epidermis usually tawny or yellowish, rarely showing any vestiges of rays; female shell much produced in the post-basal region.

PLAGIOLA CYRENOIDES (Philippi).

Shell solid, somewhat inflated, subtriangular or subquadrate, with rather full and quite high beaks, whose sculpture consists of numerous fine, doubly-looped, corrugated ridges, which gradually fade into the regular shell sculpture; posterior end obliquely truncate above, with a rounded point about midway up from the base; posterior ridge well developed; base well rounded; surface sculptured with slightly corrugated, concentric ridges; epidermis uniform tawny, tawny-green or brownish, cut with impressed radial lines, especially behind, often looped, wrinkled and granulous; left valve with two ragged pseudocardinals, the anterior one somewhat compressed, and two curved laterals, the lower higher; right valve with two pseudocardinals, the upper feeble and compressed, and one lateral; beak cavities shallow; muscle scars impressed; nacre whitish, often lurid or blotched, thinner behind. Male shell with a decided rounded point behind scarcely midway up from the base, base evenly rounded. Female shell with a

strong inflation at or behind the middle of the base; posterior point blunt, more elevated than that of the male shell.

Length (male) 54, height 43, diam. 28 mm.

Length (female) 50, height 43, diam. 26 mm.

Length (female) 44, height 41, diam. 32 mm.

Nicaragua; Venezuela? A specimen in the U. S. National Museum from the Morelet collection is marked with the latter locality.

Unio cyrenoides PHILIPPI, Zeits. für Mal., IV, 1847, p. 93; Abbild., III, 1848, p. 49, pl. v, fig. 1.— KUSTER, Conch. Cab. Unio., 1862, p. 285, pl. XCVI, fig. 1.

Margaron (Unio) cyrenoides LEA, Syn., 1852, p. 25; 1870, p. 38.

Plagiola cyrenoides SIMPSON, Syn., 1900, p. 606.

Unio newcombianus LEA, Pr. Ac. N. Sci. Phila., VIII, 1856, p. 103; Obs., VI, 1857, p. 32, pl. XXX, fig. 27; Jl. Ac. N. Sci. Phila., III, 1858, p. 312, pl. XXX, fig. 27.— von MARTENS Biol. Cent. Amer., Moll., 1900, p. 497, pl. XXIX, figs. 1, 1 *a-b*.

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

Unio sagrinatus SOWERBY, Conch. Icon., XVI, 1868, pl. LXVII, fig. 345.

Unis gabbianus, VON MARTENS, Biol. Cent. Amer., Moll., 1900, pl. XXXIX, figs. 5, 5*a-b*.

More solid and rudely sculptured, lighter colored and shorter than *Plagiola imbricata*. Von Martens' figures of *Unio gabbianus* on plate XXXIX of the Biologia certainly represent a specimen of *cyrenoides*, though his description applies to *gabbianus*.

In a female *P. cyrenoides*, which was not gravid, the sulcus near the base of the inside of the marsupium was quite deep, in fact the part above it hung over it in a sort of flap, which would no doubt disappear if it was filled with ova.

PLAGIOLA IMBRICATA (Mörch).

Shell subsolid, rather inflated, subovate or subelliptical, with a well-developed posterior ridge; beaks moderately full, their sculpture not seen, but apparently much as in *P. cyrenoides*,

surface covered with fine, granulous, concentric ridges; epidermis olive or dark olive-brown, having impressed radial lines over its hinder half, between which lines it is often looped; left valve with two subcompressed, ragged pseudocardinals and two laterals, the lower higher; right valve with one pseudocardinal, a vestigial second one above it, and one lateral; beak cavities not deep; muscle scars scarcely impressed; nacre dull, lurid or lead-color, frequently blotched. Male shell ovate, pointed behind a little above the base; female shell almost elliptical, with a decided marsupial swelling, the posterior point blunt and well elevated.

Length 37, height 28, diam. 20 mm.

Nicaragua.

Unio (Plagiola?) imbricatus MÖRCH, Mal. Blatt., VII, 1860-1, p. 205.—SIMPSON, Syn., 1900, p. 607.

Unio imbricatus VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 498, pl. XLIII, figs. 6, 6*a-c*.

Unio encarpus LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 95; Jl. Ac. N. Sci. Phila., VI, 1868, p. 294, pl. XLII, fig. 105; Obs., XII, 1869, p. 54, pl. XLII, fig. 105.

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

Plagiola encarpa SIMPSON, Syn., 1900, p. 607.

Von Martens has figured in the Biologia Mörch's *Unio imbricatus* and I agree with him that Lea's *Unio encarpus* published eight years later is a synonym of the former. There is a good deal of variation in the sculpture, some specimens scarcely showing radial grooves, while in others they are very distinct. The type of *Unio encarpus* is radially grooved.

Group of *Plagiola sallei*.

Shell triangular ovate, inflated, solid, with a high, rounded or narrowly subangulate posterior ridge; beaks full; epidermis rough and black; hinge heavy; beak cavities rather deep; nacre whitish, thicker in front; female shell with a strong marsupial swelling.

PLAGIOLA SALLEI (Crosse and Fischer).

Shell very solid and inflated, triangular ovate, inequilateral, with a high, narrow, generally slightly biangular dorsal ridge; beaks full and high, their sculpture not observed; epidermis rough, blackish, often inclined to crack off; left valve with two pseudocardinals, the hinder triangular, the anterior subcompressed, and two short, remote, solid laterals, the lower the larger; right valve with one large, triangular pseudocardinal, sometimes with a feeble second one above it, and one lateral; hinge plate rather narrow; beak cavities fairly deep; muscle scars deep; nacre white, much thickened in front. Male shell nearly or quite straight on the base, the posterior biangulation reaching to the base line; female shell with a decidedly produced marsupial swelling, its slight posterior biangulation elevated to near the middle of the height of the shell.

Length (male) 65, height 43, diam. 31 mm.

Length (male) 65, height 43, diam. 31. mm.

Length (female) 50, height 37, diam. 32 mm.

Mexico; Usumacinta and Rio Salinas rivers, Guatemala.

Unio sallei CROSSE and FISCHER, J. de Conch., XLI, 1893, p. 179.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 619, pl. LXVIII, figs. 3, 3*a*.

Var. *grossa* (von Martens).

Shell shorter and higher than the type, very solid, anterior end rounded below, obliquely truncated above; posterior ridge well defined.

Length 62, height 44, diam. 30 mm.

Guatemala.

Unio sallei var. *grossus* VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 517, pl. XXXIV, figs. 2, 2*a*, 2*b*.

There is in the National Museum collection a badly eroded old female shell sent by von Ihering from the Usumacinta River, Guatemala, that I believe belongs to the above species; probably to von Martens' variety of it. It is a dead shell, very old and somewhat diseased. The anterior half of the shell

is greatly thickened, the surface is badly eroded, so that the rough, black epidermis remains only around the later growth, and it has a decided marsupial swelling, thus precluding the possibility that the species can be a *Quadrula*.

Group of *Plagiola nicaraguensis*.

Shell much like that of *cyrenoides*, but simply covered with coarse, irregular, concentric ridges, and having no radiating grooves or wrinkles, faintly rayed in unbonal region. Animal as in the *cyrenoides* group.

PLAGIOLA NICARAGUENSIS (Lea).

Shell suboval, rather inflated, subsolid, rounded below and obliquely truncated above in front, with a well-developed, slightly rounded posterior ridge; beaks somewhat full and high, their sculpture consisting of a few fine corrugations, which are somewhat doubly looped; surface strongly concentrically sulcate, covered with a yellowish-green or olive-green epidermis, which sometimes shows a few faint rays; left valve with two subcompressed pseudocardinals and two laterals, the upper lateral small; right valve with two pseudocardinals, the upper compressed and small, and one lateral, sometimes with a vestige of a second lateral below it; beak cavities moderate, not compressed; anterior scars impressed; posterior scars shallow; nacre bluish-white, sometimes tinted yellowish or flesh-colored in the cavities of the shell.

Male shell with rounded base-line, pointed behind at some distance above the base; female shell generally higher than the male, with a wide, rounded marsupial swelling, the blunt posterior point much elevated.

Length (male) 46, height 32, diam. 23 mm.

Length (female) 40, height 30, diam. 18 mm.

Nicaragua.

Unio nicaraguensis LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 95; Jl. Ac. N. Sci. Phila., VI, 1868, p. 296, pl. XLIII, fig. 107; Obs., XII, 1869, p. 56, pl. XLIII, fig. 107.

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

Plagiola nicaraguensis SIMPSON, Syn., 1900, p. 607.

Unio gabbianus LEA, Pr. Ac. N. Sci. Phila., XII, 1868, p. 95; Jl. Ac., N. Sci. Phila., VI, 1868, p. 295, pl. XLIII, fig. 106; Obs., XII, 1869, p. 55, pl. XLIII, fig. 106.

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

Lea's type is a female shell, and the type of his *Unio gabbianus* is a male shell, which I believe belongs to the same species. I have examined a large amount of material belonging to this group and of this species and it seems to vary much in the degree of inflation and the length of its shell.

DIGENÆ.

Male shell inflated, truncated posteriorly; female shell compressed, expanded into a broad wing behind the post-ridge, the wing being filled with a flap of the mantle.

Genus TRITOGONIA Agassiz, 1852.

Tritogonia AGASSIZ, Arch. für Nat., 1852, p. 48.

Shell solid, elongate rhomboid, having a strong, irregular posterior ridge; obliquely truncated behind in the male; in the female this region is somewhat truncated and rounded; base incurved; whole surface, except the rounded wing of the females, covered with pustules; beaks rather low, incurved and turned forward over the well-developed lunule, which is elongated and filled with epidermal matter; beak sculpture strong, consisting of irregular, subparallel ridges, which are curved upward behind, and fine radiating ridges in front of and behind this; epidermis dark olive; hinge plate rather narrow; pseudocardinals strong, ragged; laterals long and straight, near to the pseudocardinals.

Animal having the inner gills much larger than the outer, generally free for the most part from the abdominal sac; palpi enormous, elongated, united to each other behind and to the mantle a part of their length; mantle thin, with a thickened, dark, double border, the inner edge often toothed throughout, the base much thickened at the posterior end and folded at the branchial opening; branchial opening large, with numerous

crowded papillæ; anal opening smooth or with only fine denticulations; superanal opening long, closed below; in the female there is a thickened flap of the mantle, which fills the circular posterior expansion of the shell, and which has a smaller flap inside; foot and abdominal sac large, the latter winged in front. Marsupiam occupying all four gills.

Type, *Unio verrucosus* Say.

The genus *Tritogonia* is one of the most remarkable in the *Unionidæ*. In all other genera and groups where the shells are sensibly dimorphous the female shell is swollen and extended at the posterior base *in front of the posterior ridge,* while the male shell is without this swelling. But in *Tritogonia* none of the shells are produced at the posterior base, but *that of the female is produced behind the posterior ridge,* spreading out in a thin, wide, rounded wing or flap at the extreme hinder end of the shell, while that of the male is obliquely truncated below and ends behind in a more or less decided point. In the other dimorphic groups the female shell has, as a rule, a greater diameter than the male, and is never more compressed. But in this peculiar form the male shell is much more inflated generally than that of the female.

TRITOGONIA TUBERCULATA (Barnes).

Shell large, elongated, solid, subrhomboid, scarcely inflated, inequilateral, with a decided, curved, elevated ridge, which ends well forward on the posterior base, in front of which for a long distance there is a shallow excavation; beaks low, compressed, sculptured with strong, irregular, corrugated ridges that turn up behind; surface covered as far back as the posterior ridge with irregular, different sized pustules, which sometimes form somewhat chevon-shaped figures; behind the ridge the sculpture consists of strong, irregular, curved, corrugated and often knobbed ridges; epidermis greenish-brown, or brown, dark green in young shells; left valve with two ragged, triangular pseudocardinals and two straight laterals; right valve with one large pseudocardinal, a small one in front of it, and vestigial teeth behind it, with one lateral, which in

heavy shells may be partly double; beak cavities moderately deep, compressed; anterior scars rough; posterior scars oval; nacre white, rarely purple. In this remarkable species the male shell is obliquely truncate at the posterior base, behind the posterior ridge and ends in a somewhat blunt point considerably above the base line. From this point running towards the beaks there is generally a row of low, broad nodules or knobs that extend upward in ridges. In the female shell this area is much smoother, and is extended into a broad, rounded wing.

Length (male) 125, height 80, diam. 40 mm.

Length (male) 150, height 88, diam. 50 mm.

Length(female) 125, height 70, diam. 35 mm.

Length (female) 190, height 103, diam. 48 mm.

Mississippi drainage generally; streams falling into the Gulf of Mexico from the Alabama system west to central Texas.

Type locality, Wisconsin.

Unio tuberculatus BARNES, Am. Jl. Sci., VI, 1823, p. 125, pl. VII, figs. 8*a*, 8*b*.—REEVE, Conch. Syst., I, 1841, p. 118, pl. LXXXVIII, fig. 5.—HANLEY, Biv. Shells, 1843, p. 182, pl. XX, fig. 27.—POTIEZ and MICHAUD, Gall. Moll., 1844, p. 158, pl. LX, fig. 1.—REEVE, Elements of Conch., 1860, II, pl. XXXIII, fig. 183.

Margarita (Unio) tuberculatus LEA, Syn., 1836, p. 17; 1838, p. 16.

Margaron (Unio) tuberculatus LEA, 1852, p. 23; 1870, p. 34.

Mya tuberculata EATON, Zool. Text-Book, 1826, p. 217.

Tritogonia tuberculata SIMPSON, Syn., 1900, p. 608.

Quadrula tuberculata ORTMANN, Ann. Car. Mus., VIII, 1912, p. 254.

Unio pustulata SWAINSON, Treat. on Mal., 1840, p. 271, fig. 54*d*.

Unio gigas SOWERBY, Conch. Icon., XVI, 1867, pl. LVI, fig. 287.

Unio verrucosus SAY, Am. Conch., VI, 1834.—KUSTER, Conch. Cab., 1862, p. 273, pl. XCII, fig. 1.—SOWERBY, Conch. Icon., XVI, 1868, pl. 1, fig. 4.

Tritogonia verrucosa AGASSIZ, Arch. für Nat., I, 1852, p. 48.
Tritigonia verrucosa SMITH, Bull. U. S. Fish Com., 1899, p. 291, pl. LXXXI.
Quadrula tritogonia ORTMANN, Naut., XXII, 1909, p. 101.
Quadrula obesa VANATTA, Naut., XXIII, 1910, p. 102.
Quadrula parkeri GEISER, The Academician, I, 1911, p. 15.

I have never seen a specimen among the hundreds examined that had young or ova in the gills. But I have seen spermatozoa in specimens with inflated shells and ova in those with the wing. Mr. H. M. Kelly, of Mount Vernon, Iowa, who has made a very careful study of the anatomy of many of our Unionidæ, assures me that the form with the compressed shell, having the expanded flap behind, is the female.

It has been claimed that this species was previously described under the name of *Obliquaria verrucosa* by Rafinesque, but I am unable to make anything out of his figure or description; hence I use the name given by Barnes. Barnes' name was used by Rafinesque for the species which the former called *Unio verrucosus,* but as Rafinesque placed his species in *Obliquaria,* and as the generic names of both forms are changed in this work, I do not consider Barnes' name preoccupied. Female shells seem to generally grow larger than those of the males.

Var. *obesa* Simpson.

Shell much smaller than the type and very much more inflated, the sculpture finer and arranged in broken ridges or nodules so as to form more or less perfect chevron-shaped patterns; posterior flap of the female less developed than in the type.

Length (male) 78, height 47, diam. 33 mm.

Length (female) 75, height 50, diam. 30 mm.

Texas; Louisiana; Mississippi.

Type locality, Big Eddy, Nechez River, Texas.

Tritogonia tuberculata var. *obesa* SIMPSON, Syn., 1900, p. 609.

This variety is distinct enough to almost have specific rank, but as I have seen only a limited amount of material and as

the species is quite variable, I place it here as a variety. Occasional specimens found as far north as southern Ohio seem to stand somewhat between the two forms.

TRITOGONIA NOBILIS (Conrad).

Shell solid, inflated, inequilateral; beaks full and high, turned forward over a strong lunule that passes underneath them, their sculpture consisting apparently of doubly-looped, zigzag bars; anterior end rounded, sometimes slopingly truncate or angled above; base incurved in front of the posterior ridge; posterior ridge double, with a radial depression in front of it, and sometimes one above it; surface generally having strong, irregular growth lines and more or less covered with tubercles. There is usually a row of rounded tubercles running down the front angle of the posterior ridge and an irregular, sometimes double, radial row of elongated knobs in front of the middle of the shell and these are stronger than the pustules on the rest of the shell; dorsal slope having curved nodulous or subnodulous ridges; epidermis brown; pseudocardinals double, strong and ragged in the left valve, single in the right, often a good deal split up; laterals straight, double in the left valve, single or occasionally semi-double in the right; beak cavities rather deep; dorsal scars in a row under the beaks; anterior scars impressed, rough; posterior scars shallow; nacre white or dull purple, iridescent behind. Male shell subquadrate; female shell drawn out behind at the biangulate termination of the posterior ridge so that it is often wedge-shaped when viewed from above, less inflated in proportion to length than the male shell.

Length (male) 80, height 69, diam. 47 mm.

Length (female) 110, height 76, diam. 47 mm.

Length (female) 114, height 77, diam. 50 mm.

Red River of the North to Mississippi; Louisiana (the type coming from Bayou Teche); west into eastern Texas.

Unio nobilis CONRAD, (part), Jl. Acad. N. Sci. Phila., II, 1854, p. 297, pl. XXVII, fig. 3.

Quadrula asper, (part), SIMPSON, Syn., 1900, p. 776.

Unio lunulatus PRATT, Pr. Dav. Acad. N. Sci., I, 1876, p. p. 167, pl. XXXI, fig. 1.

Quadrula lachrymosa var. *lunulata* SIMPSON, Syn., 1900, p. 777.

Conrad's description of *Unio nobilis* is not very explicit and he figures two specimens. His figure No. 2 is the same as Say's *apiculatus*, I am sure. Figure 3 represents a large shell 114 millimeters in length, considerably drawn out and rounded behind at the termination of the double posterior ridge. I had never seen anything like it at the time I wrote the Synopsis and thought it might be an abnormal specimen. Recently Mr. Lorraine S. Frierson has sent me two shells, one of which, from Grand River, Missouri, is almost exactly like Conrad's figure 3, being drawn out behind and decidedly wedge-shaped when viewed from above. The other is a much shorter shell, more inflated in proportion to its length and is almost squarely truncated behind, in fact the upper part of the truncation overhangs a little. Some specimens are tuberculate throughout; others show little more than the two rows of strong knobs, and a valve from the Red River of the North is slightly compressed and almost destitute of nodules. I am inclined to believe that Pratt's *Unio lunulatus* from near Rock Island, Illinois, is a smooth inflated form of Conrad's *nobilis*, a male shell probably.

I cannot be sure as to the relationships of this species, but am inclined to place it with *Tritogonia*. The female of Lea's *Unio lachrymosus* has all four of the gills filled with embryos forming smooth pads, and the shells, so far as I have seen, are not dimorphic. I have never seen a gravid *Unio tuberculatus* of Barnes, but specimens recently examined in which the shell was drawn out into a rounded wing behind appeared to have the outer gills recently filled, as the apparent ovisacs were still distended and seemed to be separated by sulci. The inner gills gave no indication of having been filled with young.

TRITOGONIA CONJUGANS (B. H. Wright).

Shell long rhomboid, solid, inflated, inequilateral; beaks probably low and compressed; posterior ridge high, and in

front there is a wide, shallow, radial depression; posterior end truncated; surface covered with strong, irregular tubercles, those on the posterior slope partially arranged in curved rows; just at and back of the posterior ridge there are faint indications of knobs; epidermis brown; left valve with two strong pseudocardinals, the posterior one bifid and two strong laterals; right valve with three pseudocardinals, the middle one much the largest, and one double lateral; anterior scars rough; posterior scars oblong; beak cavities moderately deep, compressed; pallial line deep and roughened; nacre lurid white, much thicker in front, with two faint, wide, radial depressions, one at the post-ridge, the other in front of the middle.

Length 93.75, height 68.75, diam. 50 mm.

Type locality, Hiawassee River, Tennessee.

Unio conjugans B. H. Wright, Naut., XIII, 1899, p. 89.

Tritogonia conjugans Simpson, Pr. Ac. N. Sci. Phila., 1900, p. 79, pl. IV, fig. 1.—Syn., 1900, p. 609.

I am not at all certain as to the systematic position of this species. The posterior truncation is much different from that of *T. tuberculata*, but the epidermis and tubercles, the hinge, beak cavities and pallial line are very much as in that species.

A single male shell of this remarkable species, the type, is in the U. S. National Museum collection.

Genus HEMILASTENA (Agassiz, 1852) Simpson.

Hemilastena Agassiz, Arch. für. Nat., I, 1852, p. 50.—Simpson, Syn., 1900, p. 673.

Shell small, elongate elliptical, rounded in front and behind, often slightly incurved at the central base; beaks rather sharp, but not full; sculpture consisting of fine, parallel ridges, which are looped up in the middle and open behind; epidermis brownish, rayless; teeth imperfect, a single irregular, compressed tooth in each valve; that of the left under the beak, that of the right in front of it; laterals nearly or quite wanting; anterior end of the shell much thickened; anterior muscle scars united; posterior faint; nacre dull whitish.

Marsupium filling the entire outer gills and forming enormously thickened pads, the upper part finely vertically striate, the lower part of different texture, lighter colored, wrinkled and granular on the surface; embryos very large; outer and inner gills nearly alike in size, the latter free from the abdominal sac, all united to the mantle to their posterior ends; palpi elongated, granular; mantle straight below, thickened on the border; branchial opening large, with numerous light-colored papillæ with dark lines; anal opening black, without papillæ, separated from the small superanal opening by a long bridge; hinder part of the mantle, branchial and anal openings widely separated by the very thick marsupia.

Type, *Alasmodonta ambigua* Say.

From the examination of a large series of fine specimens sent by Mr. L. E. Daniels, I can only conclude that this curious form is quite different from any other I know. The marsupium is decidedly vertically striate throughout its upper half, the lower half is lighter, granular and wrinkled externally and in places shows traces of vertical sulci as in the higher Uniones, *Lampsilis,* etc. The males seem to be much less numerous than the females, only two being found in the lot sent by Mr. Daniels. Their shells are less inflated, more nearly straight below and not so broad posteriorly; those of the females being decidedly swollen behind, the posterior ridge being very full and widely rounded, the base line sometimes a little incurved in the middle and the hinder end of the shell broad.

The shells of this little species bear a strong superficial resemblance to those of the genus *Margaritana.* They differ, however, in several minor characters and one of the most important is in the beak sculpture. That of *Hemilastena* has fine ridges, which are looped up in the middle and pass downward and backward obliquely and are open behind, while the sculpture of *Margaritana* consists of strong, straight folds. In the latter genus the mantle is more or less attached to the cavities of the shell by small muscles, which leave scars when the animal is taken out, a character not found in *Hemilastena.*

All four of the gills are united to the mantle behind to their extreme ends, while in all species of *Margaritana* they are free behind.

HEMILASTENA AMBIGUA (Say).

Shell small, oblong, with dorsal and basal lines parallel, the anterior and posterior ends rounded, inequilateral, subsolid, not inflated; beaks not full or elevated, their sculpture consisting of fine ridges looped up in the middle and open behind; posterior ridge wide and rounded, often raised above the disk; surface with delicately sulcate growth lines; epidermis greenish or olive-brown; there is a single low, smooth tooth in each valve at the beaks; nacre thin behind, where it is subtranslucent and tinted with dirty purplish; at the anterior base it is thickened and creamy white.

Length 40, height 19, diam. 12 mm.

Length 48, height 21, diam. 16 mm.

Ohio River system; north to Michigan; west to Iowa; south to Arkansas; east to Tennessee.

Type locality, Northwestern Territory.

Alasmodonta ambigua SAY, Jl. Ac. N. Sci. Phila., V, 1825, p. 131.

Margaritana ambigua KUSTER, Conch. Cab. Unio, 1862, p. 300, pl. XCIX, fig. 7.

Hemilastena ambigua SIMPSON, Syn., 1900, p. 673.

Unio hildrethianus LEA, Tr. Am. Phil. Soc., V, 1834, p. 36, pl. III, fig. 8; Obs., I, 1834, p. 148, pl. III, fig. 8.—HANLEY, Biv. Shells, 1843, p. 196, pl. XXIII, fig. 38.—KUSTER, Conch. Cab. Unio, 1861, p. 206, pl. LXVIII, fig. 8.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVI, fig. 192.—BAKER, Moll. Chicago, Pt. I, 1898, p. 71, pl. V, fig. 4.

Margarita (Unio) hildrethianus LEA, Syn., 1836, p. 28; 1838, p. 20.

Margaron (Margaritana) hilarethianus LEA, Syn., 1852, p. 43; 1870, p. 69.

Strophitus hildrethiana CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 263.

Baphia hildrethiana H. and A. Adams, Gen. Rec. Moll., II, 1857, p. 499.
Margaritana hildrethiana B. H. Wright, Check List, 1888.
Alasmodonta dubia Ferussac, Guer. Mag., 1835, p. 26.

MESOGENÆ.

Male and female shells alike, short, solid, inflated; embryos occupying a few distinct ovisacs in the center of the outer gills.

Genus CYPROGÊNIA Agassiz, 1852.

Cyprogenia Agassiz, Arch. für Nat., 1852, p. 47.—Ortmann, Ann. Car. Mus., VIII, 1912, p. 312.

Shell solid, inflated, rounded triangular, sometimes slightly retuse, generally a little biangular behind; posterior ridge unusually well developed, especially in the young shell; unbonal region flattened parallel with the axis of the shell, sometimes compressed; beaks curved inward and forward, their sculpture very faint, consisting of slightly doubly-looped ridges; sculpture of the shell nodular, radiately wrinkled or lachrymose; ligament black and conspicuous; lunule distinct and well developed; epidermis shining, painted with a delicate, dark mottling on a light ground; hinge plate wide and flat; pseudocardinals heavy, triangular, blunt and ragged; laterals short, obliquely striated; cavity of the beaks not deep; adductor scars small, well impressed, those at the posterior round; nacre bright and silvery. Animal having the inner gills partly free from the abdominal sac, rounded below; outer gills smaller; marsupium consisting of from seven to twenty-three very long, purple ovisacs pendent from near the central base of the outer gills and formed into a close coil with the ends turned inwardly; branchial opening large, with many small papillæ; anal opening smooth.

Type, *Unio irroratus* Lea.

Cyprogenia irrorata (Lea)

Shell suborbicular or rounded triangular, very solid, inflated; beaks high and full but flattened, central or a little

nearer the anterior end, curved forward over the lunule and having very feeble sculpture; posterior ridge well developed, high and narrowly rounded at the umbonal region, with a shallow, radial groove in front of and another behind it; surface having strong, low, concentric ridges, each ridge sometimes equaling a season's growth; sometimes they are more numerous; in addition to this it is more or less covered with irregular knobs or tubercles; epidermis pale greenish-yellow covered with a pattern of rich green flecks or dots, which shows a tendency to form rays; left valve with two strong, low, ragged pseudocardinals and two laterals; right valve with one pseudocardinal and one double lateral; hinge plate wide and flat; beak cavities rather shallow, compressed; muscle scars small, deep; nacre silvery, white or flesh-colored, thicker in front.

Length 55, height 50, diam. 35 mm.

Length 42, height 47, diam. 30 mm.

Ohio, Cumberland and Tennessee River systems; St. Francis and Saline Rivers, Arkansas? Eastern Iowa? The specimens reported from the western localities may be *C. aberti.*

Type locality, Ohio.

Unio irroratus LEA, Tr. Am. Phil. Soc., III, 1830, p. 269, pl. v, fig. 5; Obs., 1, 1834, p. 11, pl. v, fig. 5.—HANLEY, Biv. Shells, 1843, p. 181, pl. xx, fig. 25.—CHENU, Ill. Conch., 1858, pl. x, figs. 3, 3*a*, 3*b*.—REEVE, Conch., Icon., XVI, 1864, pl. xii, fig. 44.

Margarita (Unio) irroratus LEA, Syn., 1836, p. 16; 1838, p. 15.

Margaron (Unio) irroratus LEA, Syn., 1852, p. 22; 1870, p. 34.

Unio irrorata DESHAYES, Encyc. Meth., II, 1830, p. 579.

Theliderma irrorata SWAINSON, Tr. on Mal., 1840, p. 271, fig. 54*a*.

Cyprogenia irrorata SIMPSON, Syn., 1900, p. 610.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 312, fig. 17.

Unio verrucosus albus HILDRETH, Am. Jl. Sci., XIV, 1828, p. 281.

Unio stegarius Say, Am. Conch., VI, 1834.—Conrad, Monog., X, 1838, p. 83, pl. xlvi, fig. 1.—Reeve, Conch. Icon., XVI, 1864, pl. xl, fig. 45.

Unio stegarius var. *irroratus* Pætel, Conch. Sam., III, 1890, p. 168.

Var. *pusilla* Simpson.

A peculiar, dwarfed variety, about one-half the size of the ordinary form and much inflated.

Length 36, height 35, diam. 27 mm.

Length 43, height 37, diam. 29 mm.

Cyprogenia irrorata var. *pusilla* Simpson, Syn., 1900, p. 610. Type locality, Green River, Kentucky.

The species is quite variable in form, but it always is flattened on the beaks and upper part of the disk and has the characteristic color pattern, which I have described. It is more inflated and generally more pustulous than the nearly allied *C. aberti,* but there are intermediate forms that can only be placed with difficulty.

Cyprogenia aberti (Conrad).

Shell somewhat rhomboid, solid, but slightly inflated, with low, compressed beaks placed a little in front of the middle, which are turned forward slightly over the lunule and have very faint sculpture; posterior ridge rather sharp above, gradually becoming less distinct and sometimes slightly double in the later growth; disk flattened above; posterior slope with a wide, shallow, radial furrow behind the posterior ridge. Surface with low, wide, concentric ridges, which are strongest above the rest periods and in addition to this it is more or less subvertically wrinkled; epidermis scarcely shining, yellowish-green with dots and flecks of dark green arranged in broken rays; hinge plate enormously wide and flat; left valve with two low, radial pseudocardinals and two low, wide laterals, the lower often blurred; right valve with one pseudocardinal, sometimes with a feeble one on each side of it, and a low double or triple lateral; beak cavities shallow, compressed;

muscle scars very small, smooth, impressed; nacre white, much thicker in front.

Length 76, height 67, diam. 40 mm.

Kansas; Missouri; Indian Territory; Arkansas.

Type locality, Verdigris River, Ark.

Unio aberti CONRAD, Pr. Ac. N. Sci. Phila., V, 1850, p. 10; Jl. Ac. N. Sci. Phila., 1854, p. 295, pl. XXVI, fig. 1.

Margaron (Unio) aberti LEA, Syn., 1870, p. 34.

Cyprogenia aberti SIMPSON, Syn., 1900, p. 610.

Unio popenoi CALL, Bull. Washb. Coll., I, 1885, p. 49, pl. II.

Larger, less inflated and having a wider hinge plate than *C. irrorata.*

Var. *lamarckiana* LEA.

Smaller, more truncate behind, darker than the type, and apparently well worthy of a varietal name.

Arkansas.

Type locality, Caddo River and Ouachita River, Hot Springs, Ark.

Unio lamarckianus LEA, Tr. Am. Phil. Soc., X, 1852, p. 266, pl. XVII, fig. 20; Obs., V, 1852, p. 22, pl. XVII, fig. 20.—SOWERBY, Conch. Icon., XVI, 1868, pl. XCII, fig. 498.

Margaron (Unio) lamarckianus LEA, Syn., 1852, p. 23.

Genus OBLIQUARIA (Rafinesque 1820) Simpson.

Obliquaria RAFINESQUE, Ann. Gen. Sci. Phys. Brux., 1820, p. 301.—SIMPSON, Syn., 1900, p. 610.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 309.

Shell inflated, solid, oval, ending in a tolerably sharp point behind, having a row of large, compressed, longitudinal knobs running from the beaks to the center of the base, those of one valve alternating in position with the knobs of the other, and a well-developed posterior ridge, the space between the ridge and knobs somewhat excavated; posterior slope and sometimes the entire shell more or less corrugately sculptured; beaks prominent, incurved, and pointed slightly forward toward a

tolerably well-developed lunule; beak sculpture strong, consisting of four or five heavy, parallel ridges, which fall low in front but are curved upward behind; epidermis smooth, generally shining, painted with numerous delicate, wavy, darker, broken rays; pseudocardinals strong, direct, and ragged; laterals short, nearly straight; anterior muscle scars small, the sides of the pit smooth, the bottom ragged; front part of the shell very solid, suddenly becoming rather thin just behind the knobs; male and female shells essentially alike.

Animal having the branchiæ small, rounded below, inner the larger, free from the abdominal sac in part; marsupium consisting of a few distinctly marked ovisacs (4 to 7), occupying a position just behind the center of the outer gills, projecting below the rest of the branchiæ, their bases rounded; mantle cut away at the thinner portion of the shell; anal opening smooth or having only minute crenulations.

Type, *Obliquaria reflexa* Rafinesque.

OBLIQUARIA REFLEXA Rafinesque.

Shell irregularly oval, inflated, solid, inequilateral, with rather high, full beaks, which are turned forward over a small lunule, their sculpture consisting of three or four coarse, oblique ridges; posterior ridge well developed; surface sculptured with a central radial row of four or five strong, longitudinally compressed knobs, and besides these there are occasional slight corrugations or wrinkles; epidermis generally smooth and subshining, yellowish-green, usually covered with delicate, wavy, more or less broken rays, often uncolored. Sometimes these rays consist of small dots and again of arrow-head markings; posterior end of shell obliquely truncate above; left valve with two ragged, radial, stumpy pseudocardinals and two slightly curved laterals; right valve with one triangular pseudocardinal, often with a vestigial tooth on each side of it, and one double lateral; muscle scars small, the anterior ones rough; beak cavities shallow; nacre white, straw-colored, salmon or reddish, much thicker in front. Male and female shells scarcely differing.

Length 52, height 45, diam., without the knobs, 27 mm., diam. over all 33 mm.

Mississippi drainage; Michigan; Alabama River; southwestwardly to central Texas.

Type locality, Kentucky River and Rapids of Letart.

Obliquaria (Quadrula) reflexa RAFINESQUE, Ann. Gen. Sci. Phys., 1820, p. 306.

Obliquaria reflexa BAKER, Moll. Chicago, Pt. I, 1898, p. 89, pl. XIV, fig. 5; XX, fig. 2.—SIMPSON, Syn., 1900, p. 611.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 310, fig. 16.

Unio reflexus SAY, Am. Conch., VI, 1834.—CONRAD, Monog., I, 1835, p. 7, pl. IV, fig. 1.—KUSTER, Conch. Cab. Unio, 1852, p. 52, pl. XI, fig. 2.—REEVE, Conch. Icon., XVI, 1864, pl. VI, fig. 23.

Unio cornutus BARNES, Am. Jl. Sci., VI, 1823, p. 122, pl. IV, fig. 5, 5*a*, 5*b*, 5*c*.—HANLEY, Biv. Shells, 1843, p. 179, pl. XX, fig. 30.

Margarita (Unio) cornutus LEA, Syn., 1836, p. 15; 1838, p. 15.

Margaron (Unio) cornutus LEA, Syn., 1852, p. 22; 1870, p. 33.

Mya cornuta EATON, *Zool.* Text-book, 1826, p. 216.

Theliderma cornuta SWAINSON, Treat. on Mal., 1840, p. 269.

Unio torulosus SHORT and EATON, Transylvania Jl., 1831, p. 75.

Var. *phillipsi* (Conrad).

Shell more compressed than the type, more evenly oval, less distinctly pointed behind, often decidedly corrugately wrinkled; epidermis with broken rays or rayless; smaller than the type.

Length 40, height 35, diam., over all 23 mm.

Type locality, Wabash River.

Unio phillipsii CONRAD, Monog., I, 1835, p. 9, pl. V. fig. 1.

Unio phillipsii CATLOW and REEVE, Conch. Nom. 1845, p. 62.—KUSTER, Conch. Cab. Unio, 1852, p. 50, pl. X, fig. 3.

Margarita (Unio) phillipsii LEA, Syn., 1836, p. 15; 1838, p. 15.

Margaron (Unio) phillipsii LEA, Syn., 1852, p. 22; 1870, p. 33.

Unio philipsii HANLEY, Test. Moll., 1842, p. 178.

Obliquaria reflexa, (part), SIMPSON, Syn., 1900, p. 611.

This remarkable species does not appear to be closely related to any living form. The shells bear some resemblance to those of certain males of *Truncilla perplexa,* but in that species the female shells differ remarkably from those of *O. reflexa.* The knobs in this species are more pinched up and larger than they are in *T. perplexa* and the shell is shorter.

I am sorry to have to place the very appropriate and well-known name of Barnes in the synonymy, but I believe that the description of Rafinesque for his *Obliquaria reflexa* defines this species and nothing else, and although it is not figured, I feel justified in using his name.

PTYCHOGENÆ.

Male and female shells essentially alike; embryos contained in distinct ovisacs with rounded bases, occupying the entire outer gills, which, when gravid, consist of a series of folds.

Genus PTYCHOBRANCHUS Simpson, 1900.

Ptychobranchus Simpson, Pr. Ac. N. Sci. Phila., 1900, p. 79. —Ortmann, Ann. Car. Mus., VIII, 1912, p. 305.

Shell triangular, solid, sometimes becoming arcuate in old specimens, umbonal region rather elevated; beak sculpture consisting of faint, somewhat broken ridges, which have a tendency to be doubly looped; posterior ridge rounded but well developed; epidermis usually painted with wavy, hair-line rays or broken, radiating bars, which show a tendency to form square spots; hinge plate rather wide and flat; pseudocardinals small, low, triangular and roughened; laterals club-shaped, remote; cavity of the beaks shallow; muscle scars rather deep. Animal having the inner gills free all or part of their length from the abdominal sac; marsupium occupying the basal half of the whole length of the outer gills and hanging in from six to twenty beautiful folds; ovisacs distinct, each ending below in an enlarged, rounded bulb, which has a colored spot in its center; mantle thin, with a dark, thickened border;

branchial opening large, with very minute papillæ or crenulations, sometimes smooth; anal opening crenulate or smooth.

Type, *Unio phaseolus* Hildreth.

A small group of species confined to the Mississippi and Alabama River drainage systems, excepting *P. phaseolus*, which extends into the St. Lawrence area. The shells are not remarkable, being rather solid and varying from triangular to long elliptical, having generally broken or wavy rays and club-shaped laterals. The animal differs but little in obvious characters from that of *Unio*, but at the time when the female is gravid a most marvelous change takes place in the outer gills. The plain surface becomes gradually wavy and is then filled with embryos occupying distinctly marked ovisacs, each having a sort of bulb at its base, and when in this condition the entire outer gills hang in a series of remarkable and beautiful folds like those of a rich, heavy curtain. As soon as the embryos are discharged the lower borders of the gills contract until they are merely wavy and they finally become perfectly plain again.

KEY TO SPECIES OF PTYCHOBRANCHUS.

Shell long-elliptical or long-triangular.
  Surface smooth.
    Tawny, with or without broken rays. *P. phaseolus.*
    Greenish, with delicate, wavy rays. *P. clintonense.*
  Surface plicate posteriorly. *P. subtentum.*
Shell short or of moderate length, triangular.
    Tawny, with or without broken rays.
P. foremanianum; greeni.
    Dirty green, feebly rayed, inflated. *P. trinacrium.*

PTYCHOBRANCHUS PHASEOLUS (Hildreth).

Shell long elliptical, long ovate or long subtriangular, inequilateral, solid, subcompressed to subinflated; beaks low, sometimes slightly inflated, their sculpture very faint corrugations; posterior ridge generally moderately developed; surface with irregular, strong growth lines; epidermis tawny, having a few broken, green rays, sometimes rayless; left valve

with two low, solid, rather small pseudocardinals and two club-shaped laterals, the hinge plate being obliquely truncate behind; right valve with one pseudocardinal and vestigial ones in front of and behind it, with one strong lateral, which sometimes has vestigial ones above and below it; beak cavities very shallow, with faint dorsal scars; muscle scars well impressed, smooth; nacre silvery-white, with one or two oblique shallow grooves.

Length 100, height 60, diam. 33 mm.

Length 90, height 55, diam. 25 mm.

Length 90, height 45, diam. 25 mm.

Ohio, Tennessee, and Cumberland River systems; Lower Peninsula of Michigan; Kansas; Arkansas; Indian Territory; Louisiana. It is quite probable that some of the specimens reported from the southwestern part of the range belong to the next species.

Type locality, Muskingum River, O.

Unio phaseolus HILDRETH, Am. Jl. Sci., XIV, 1828, p. 283.—SAY, Am. Conch., No. III, 1830, pl. XXII.—HANLEY, Biv. Shells, 1843, p. 207, pl. XX, fig. 50.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 31, pl. IX, figs. 1-6.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIII, fig. 378.

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

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

Ptychobranchus phaseolus SIMPSON, Syn., 1900, p. 613.

Unio planulatus LEA, Tr. Am. Phil. Soc., III, 1830, p. 431, pl. IX, fig. 13; Obs., I, 1834, p. 45, pl. IX, fig. 13.—CHENU, Ill. Conch., 1858, pl. XIII, figs. 1, 1*a*, 1*b*; Manual, 1859, II, p. 137, fig. 659.

Unio planulata DESHAYES, An. sans Vert., 3d ed., II, 1839, p. 672.

Unio fasciolaris CONRAD, New F. W. Shells, 1834, p. 69.—KUSTER, Conch. Cab., 1861, p. 172, pl. LIV, figs. 1-4.

Unio compressissimus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 163; Tr. Am. Phil. Soc., X, 1848, p. 81, pl. VIII, fig. 33; Obs., IV, 1848, p. 81, pl. VIII, fig. 23.

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

Var. *camelus* (Lea).

Shell solider, more inflated and much more arched or humped dorsally than the type.

Type locality, Ohio River.

Unio camelus Lea, Tr. Am. Phil. Soc., V, 1834, p. 102, pl. xv, fig. 45; Obs., I, 1834, p. 214, pl. xv, fig. 45.—Hanley, Biv. Shells, 1843, p. 184, pl. xxi, fig. 54.—Sowerby, Conch. Icon., XVI, 1867, pl. lv, fig. 283.

Margarita (Unio) camelus Lea, Syn., 1836, p. 19; 1838, p. 17.

Margaron (Unio) camelus Lea, Syn., 1852, p. 24; 1870, p. 37.

The variety is quite differently shaped from the type, but there is a complete connection of the two by intermediate specimens. The humped character is shown in the young shells as well as in the adults.

The species is a variable one in form and color. Specimens from Arkansas show somewhat linear rays and approach *P. clintonense*. Old shells are sometimes decidedly arcuate, especially in the variety.

Ptychobranchus clintonense Simpson.

Shell oblong, ovate, elliptical or subrhomboid, sometimes subtriangular, solid, scarcely inflated, rather wider behind; posterior ridge feeble, rounded or slightly double, ending behind in a faint biangulation; beaks low and not inflated, their sculpture not seen; surface nearly smooth, yellowish-green covered with delicate, wavy, green, faint rays; epidermis silky when fresh, but nearly smooth when rubbed; hinge solid; left valve with two low, small, solid pseudocardinals, the hinder larger and sometimes dentilate, with two remote laterals; right valve with one pseudocardinal and a vestigial one on each side of it, with one, sometimes more or less double, lateral; beak cavities shallow; muscle scars smooth and impressed; nacre bluish-white, often with lurid blotches, thicker in front.

Length 90, height 47, diam. 28 mm.

Little Red River, Arkansas; Indian Territory (?); southwest Tennessee (?).

Type locality, Archie's Fork of the Little Red River, Clinton, Ark.

Ptychobranchus clintonensis SIMPSON, Pr. Ac. N. Sci. Phila., 1900, p. 79, pl. v, fig. 3; Syn., 1900, p. 613.

Quite variable in outline, a large series of shells from the type locality includes long ovate, long elliptical, and slightly obovate forms, and a few of the older ones are a little arcuate. Some of the specimens very closely resemble *Unio gibbosus,* but the pattern of delicate wavy rays seems to be constant and is very different from anything I have seen in that species. The animal is different, and the gravid female has the wonderfully folded marsupium occupying the entire outer gills, as in *P. phaseolus, foremanianum,* etc.

PTYCHOBRANCHUS FOREMANIANUM (Lea).

Shell exceedingly variable in form, more or less inequilateral, short to long triangular, scarcely subinflated to inflated, wide and rounded or narrow and pointed behind, with high, rather full beaks, their sculpture not seen; posterior ridge well developed, often single though occasionally somewhat double; rest periods often marked by a concentric groove, which sometimes shows as a dark line; surface pale dirty yellow, tawny or yellowish-green, generally with more or less broken rays; sometimes these are wavy and nearly entire, again they may appear as squarish spots or the two patterns may be combined in one shell; often the whole surface is entirely rayless; left valve with two pseudocardinals and two laterals; right valve with one pseudocardinal and one double lateral; beak cavities shallow; nacre white, sometimes tinted buff, often thicker in front.

Length 62, height 36, diam. 23 mm.

Length 53, height 35, diam. 26 mm.

Length 46, height 32, diam. 21 mm.

Length 57, height 35, diam. 20 mm.

Alabama River drainage.

Type locality, Coosa River, Ala.

Unio foremanianus LEA, Pr. Am. Phil. Soc., II, 1842, p. 224; Tr. Am. Phil. Soc., VIII, 1842, p. 247, pl. XXVII, fig. 64; Obs., III, 1842, p. 85, pl. XXVII, fig. 64.—CHENU, Ill. Conch., 1858, pl. XXVI, figs. 1, 1*a*, 1*b*.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXVII, fig. 202.

Margaron (Unio) foremanianus LEA, Syn., 1852, p. 23; 1870, p. 36.

Ptychobranchus foremanianus SIMPSON, Syn., 1900, p. 613.

Unio woodwardius LEA, Pr. Ac. N. Sci. Phila., IX, 1857, p. 170.

Unio woodwardianus LEA, Jl. Ac. N. Sci. Phila., IV, 1859, p. 199, pl. XXIII, fig. 82; Obs., VII, 1859, p. 17, pl. XXIII, fig. 82.—?REEVE, Conch. Icon., XVI, 1864, pl. XVI, 73.

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

Unio velatus CONRAD, Jl. Ac. N. Sci. Phila., 1853, p. 298, pl. XXVII, fig. 6.

It will be seen from the above description and measurements that I include a great variety of forms under the name *foremanianum*. The types of this and *woodwardianus* differ but little in form, but are colored differently. Specimens from the Call collection show the wavy rays and square blotches together. There are so many cross characters that I am not able to designate any forms, which seem to be worthy of varietal names.

PTYCHOBRANCHUS TRINACRIUM (Lea).

Shell long triangular, somewhat inequilateral, inflated, very solid, with high, full beaks, whose sculpture has not been seen; posterior ridge high, sharp, single, curved down in the middle, and ending in a sharp point behind, just above the base line; surface with irregular growth lines; epidermis concentrically wrinkled, dull, dirty yellowish-green with wide, darker green, faint rays, which cover most of the shell, posterior slope almost truncated, lighter colored than the rest of the shell, with a few faint, narrow rays; hinge strong, the plate flat; left valve with two low pseudocardinals and two laterals, the lower the stronger and club-shaped; right valve with one pseu-

docardinal and one strong, somewhat double lateral; beak cavities shallow; muscle scars small, and deep; nacre white with a deep, wide, oblique furrow in the center, thicker in front.

Length 50, height 34, diam. 24 mm.

Type locality, Coosa River, Alabama.

Unio trinacrus LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 59; Jl. Ac. N. Sci. Phila., V, 1862, p. 86, pl. XII, fig. 235; Obs., VIII, 1862, p. 90, pl. XII, fig. 235.—SOWERBY, Conch. Icon., XVI, pl. LXXXI, fig. 428.

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

Ptychobranchus trinacrus SIMPSON, Syn., 1900, p. 614.

I am very strongly inclined to believe that this is merely a form of *P. foremanianum*, but I have seen no material absolutely connecting it. The color pattern is different from anything known in that species and the single, sharp, high posterior ridge, which curves down in the middle is a differential character. Lea speaks of the deep groove in the cavity of the shell as a distinguishing feature, but the same thing, perhaps not quite so strongly developed, is found in specimens of *foremanianum*, and so are the heavy, club-shaped laterals an occasional character of that form. I have only seen the type.

PTYCHOBRANCHUS GREENI (Conrad).

Shell subtriangular, somewhat elongated, subinflated to inflated, subsolid, with a rather well-developed, more or less double, posterior ridge; beaks full and high, placed nearer the anterior end, their sculpture not seen; epidermis yellow or tawny, often with a few delicate rays posteriorly, subshining; left valve with two small pseudocardinals and two laterals, the lower club-shaped; right valve with one pseudocardinal, with occasional vestiges of another on each side of it, and one divided lateral; beak cavities shallow; muscle scars impressed; nacre whitish, a little thicker in front.

Length 52, height 32, diam. 26 mm.

Length 49, height 30, diam. 20 mm.

Length 40, height 25, diam. 18 mm.

Length 43, height 27, diam. 15 mm.

Black Warrior River, Alabama.

Type locality, headwaters of the Black Warrior River, Ala.

Unio greeni CONRAD, New F. W. Shells, 1834, p. 32, pl. IV, fig. 1.—CONRAD, Monog., VIII, 1837, p. 69, pl. XXXVIII, fig. 2.—HANLEY, Biv. Shells, 1843, p. 191, pl. XXIV, fig. 6.—CHENU, Bib. Conch., 1st. ser., 1845, p. 17, pl. III, fig. 5.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLVII, fig. 253.

Margarita (Unio) greeni LEA, Syn., 1836, p. 24; 1838, p. 19.

Margaron (Unio) greeni LEA, Syn., 1852, p. 27; 1870, p. 42.

Ptychobranchus greeni SIMPSON, Syn., 1900, p. 614.

Unio simplex LEA, Pr. Am. Phil. Soc., IV, 1845, p. 163; Tr. Am. Phil. Soc., X, 1848, p. 76, pl. V, fig. 15; Obs., IV, 1848, p. 50, pl. V, fig. 15.

Margaron (Unio) simplex LEA, Syn., 1852, p. 27; 1870, p. 42.

Unio flavescens LEA, Pr. Am. Phil. Soc., IV, 1845, p. 163; Tr. Am. Phil. Soc., X, 1848, p. 72, pl. III, fig. 9; Obs., IV, 1848, p. 46, pl. III, fig. 9.

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

Ptychobranchus flavescens SIMPSON, Syn., 1900, p. 614.

Since writing the Synopsis I have seen some additional material of the three forms I have placed together, and I cannot find any good characters, on which to separate them. Lea's *flavescens* is probably not mature and approaches *foremanianum* somewhat in form. His *simplex*, though not a large shell, appears to be adult, and is somewhat more inflated than *flavescens*. The species, as I recognize it, is smaller and more delicate than *foremanianum* and is, on the whole, more nearly elliptical in outline.

PTYCHOBRANCHUS SUBTENTUM (Say).

Shell medium to rather large, elongate, slightly obovate and subrhomboid, with a low, rounded posterior ridge; narrowed and rounded in front, solid, scarcely inflated; surface smooth and shining in young, and well preserved shells radiately plicate or corrugated on the posterior slope, greenish-yellow or yellowish-green, generally having a few broken, wide rays; the rays often break into square spots; at other times the markings are zigzagged and nebulous; left valve with two stumpy, small

pseudocardinals, a narrow, curved hinge plate, and two heavy, club-shaped laterals; right valve with one pseudocardinal and one lateral; beak cavities shallow; muscle scars well impressed; nacre bluish to flesh-color or yellowish. The male shell is somewhat arcuate when old and is generally rounded behind; that of the female has the basal region slightly produced and the rounded posterior point raised a little above the base line.

Length (male) 110, height 58, diam. 35 mm.

Length (male) 75, height 35, diam. 23 mm.

Length (female) 82, height 40, diam. 25 mm.

Tennessee and Cumberland River systems.

Type locality, North Fork of the Holston River.

Unio subtentus SAY, Jl. Ac. Sci. Phila., V, 1825, p. 130; Am. Conch., I, No. 2, 1831, pl. XV.—CONRAD, Am. Jl. Sci., XXVI, 1834, p. 343, pl. 1, fig. 1; Monog., X, 1838, p. 85, pl. XLVIII, fig. 1.—HANLEY, Biv. Shells, 1843, p. 176, pl. XX, fig. 34.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 25, pl. IV, figs. 2, 2*a*, 2*b*.—KUSTER, Conch. Cab. Unio, 1856, p. 164, pl. XLVII, fig. 4.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXII, fig. 370.

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

Margaron (Unio) subtentus LEA, Syn., 1852, p. 21; 1870, p. 32.

Medionidus subtentus SIMPSON, Syn., 1900, p. 591.

Ptychobranchus subtentus ORTMANN, Ann. Car. Mus., VIII, 1912, p. 308, fig. 15.

Unio subtenta DESHAYES, An. sans Vert., 2d ed., VI, 1835, p. 555.

Ortmann, (l. c.), has recently shown that this species is a *Ptychobranchus* and not a *Medionidus*.

ESCHATIGENÆ.

Male and female shells alike; embryos in distinct, short ovisacs forming a border to the entire outer gills.

Genus DROMUS Simpson, 1900.

Dromus Simpson, Syn., 1900, p. 614.—Ortmann, Ann. Car. Mus., VIII, 1912, p. 314.

Shell solid, rounded-triangular; beaks well forward, rather high; beak sculpture consisting of fine ridges running parallel with the growth lines, the furrows between the ridges interrupted at the posterior ridge; posterior ridge distinct; a series of humps runs from the beaks down to the central part of the base of the shell, which is otherwise sculptured by irregular, concentric ridges; epidermis beautifully painted by undulated, radiating, broken hair lines or fine maculations; hinge plate wide and flat; pseudocardinals triangular, small and low, ragged; laterals low, short, club-shaped; cavity of the beaks deep and compressed, dorsal muscle scars on the under side of the hinge shelf; adductor scars small; front part of the shell very thick, suddenly becoming thinner at the row of humps; male and female shells much alike.

Animal with the inner branchiæ much the larger, curved below, free from the abdominal sac; marsupium occupying the base of nearly the whole outer branchiæ in numerous, rather indistinctly marked ovisacs, bases of the ovisacs slightly rounded; ova very minute; palpi small, curved; branchial opening very large, extending one-third of the way along the base, fringed with many brown papillæ; anal opening very large, finely crenulated.

Type, *Unio dromas* Lea.

Dromus dromas (Lea).

Shell subtriangular or subelliptical, inflated, solid, somewhat inequilateral, with full, high beaks, whose sculpture consists of fine ridges running parallel with the growth lines, the furrows interrupted at the posterior ridges; surface with irregular, concentric growth lines or ridges, with a decidedly strong concentric ridge around the earlier growth of the shell. This ridge is raised into a heavy irregular knob or hump about on the median line of the shell and sometimes there is a curved row

of smaller knobs at the median line; epidermis shining, tawny, or greenish-yellow with two patterns of broken rays. One of these consists of several contiguous, narrow rays composed of dots or broken lines; these alternate with wide rays, made of peculiar blotches and fleckings of green; hinge plate wide and flat; left valve with two low, rough pseudocardinals, the hinder larger, and two short, remote laterals; right valve with three pseudocardinals, the middle one much the largest, and one divided lateral; beak cavities deep, compressed; muscle scars very small, impressed, the anterior ones rough; pallial line distant from the border in front; nacre white or buff, sometimes salmon-red behind, thickened in front.

Length 70, height 60, diam. 40 mm.

Length 80, height 67, diam. 40 mm.

Tennessee and Cumberland River systems.

Type locality, Harpeth River; Cumberland River, Nashville, Tenn.

Unio dromas LEA, Tr. Am. Phil. Soc., V, 1834, p. 70, pl. x, fig. 29; Obs., I, 1834, p. 182, pl. x, fig. 29.—CONRAD, Monog., X, 1838, p. 84, pl. XLVI, fig. 2.—HANLEY, Biv. Shells, 1843, p. 181, pl. XXIII, fig. 25.—KUSTER, Conch. Cab. Unio, 1861, p. 172, pl. LIII, figs. 3, 4.—REEVE, Conch. Icon., XVI, 1864, pl. VIII, fig. 29.

Margarita (Unio) dromas LEA, Syn., 1836, p. 16; 1838, p. 16.

Cyprogenia dromas AGASSIZ, Arch. für Naturg., I, 1850, p. 48.

Margaron (Unio) dromas LEA, Syn., 1852, p. 23; 1870, p. 34.

Dromus dromus SIMPSON, Syn, 1900, p. 615.

Dromus dromas ORTMANN, Ann. Car. Mus., VIII, 1912, p. 315, fig. 18.

A peculiar Naiad both in the character of the shell and marsupium. The pattern of coloring in fine specimens is one of the most beautiful among the Unionidæ. The shell characters would seem to ally it rather closely to *Cyprogenia*, but the marsupium is totally different from what it is in that group, consisting of a fringe of short, distinct ovisacs bordering the entire outer gills, while in *Cyprogenia* it consists of a few

long, coiled ovisacs placed in the center of the outer gills. So different is this marsupium from any other known form that I have been compelled to give it supergeneric rank.

DROMUS CAPERATUS (Lea).

Shell subelliptical, rather solid, subinflated, somewhat inequilateral, with rather high but slightly compressed beaks, which turn forward a little over a deep lunule; posterior ridge sharp above, fading out below; surface with low, irregular, concentric ridges and growth lines with one rather stronger ridge on the earlier growth, and often with one or more low knobs placed on the median line; epidermis greenish-yellow, with two sets of rays rather faintly indicated, consisting of bands of broken lines or dots, with narrower, alternating rays made up of blotches and flecks of green; hinge plate wide; left valve with two low pseudocardinals, the hinder larger, and two short laterals; right valve with three pseudocardinals, the anterior and posterior ones vestigial, and one somewhat blurred or bifid lateral; beak cavities deep and compressed; muscle scars small, somewhat impressed; pallial line rather distant from the border in front; nacre silvery, white, straw-color, often salmon or red behind, thickened in front.

Length 60, height 52, diam. 25 mm.

Tennessee River system.

Type locality, Clinch River, Tenn.

Unio caperatus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164; Tr. Am. Phil. Soc., X, 1848, p. 75, pl. v, fig. 14; Obs., IV, 1848, p. 75, pl. v, fig. 14.—REEVE, Conch. Icon., XVI, 1864, pl. v, fig. 19.

Margaron (Unio) caperatus LEA, Syn., 1852, p. 22; 1870, p. 34.

Dromus caperatus SIMPSON, Syn., 1900, p. 615.

Unio abacoides HALDEMAN, Pr. Ac. N. Sci. Phila., III, 1846, p. 75.

I am almost certain that this is only a variety of *D. dromas*, but I have never been able to quite connect the two. The description of this species exactly fits the other except that this shell is more compressed, a little more delicate, rather less

solid and is perhaps not quite so distinctly and richly painted. As it is a more compressed shell the beaks are naturally not quite so full as they are in *D. dromas*.

DIAGENÆ.

Male and female shells alike; embryos contained in the outer gills in short ovisacs, which run crosswise of the branchiæ, and are discharged entire into the water.

Genus STROPHITUS Rafinesque, 1820.

Strophitus Rafinesque, Ann. Gen. Sci. Phys. Brux., 1820, p. 316.—Ortmann, Ann. Car. Mus., 1912, p. 299.

Uniopsis Agassiz, Arch. für Nat., I, 1852, p. 49.

Shell elliptical to rhomboid, inflated, subsolid, pointed or biangulate behind, with low posterior ridge, which is sometimes double; beaks full, sculpture consisting of a few strong, concentric ridges, which run nearly parallel with the growth lines and curve upward behind; epidermis rayed or rayless, dull or shining; hinge line incurved in front of the beaks; teeth rudimentary, a vestigial, compressed tooth in each valve, and sometimes a secondary tooth; laterals rarely present; muscle scars shallow.

Animal having the marsupium occupying the whole outer gills, consisting of short horizontal ovisacs, which run directly across the gills, and are discharged through the outer wall, with the ovules in them; ovules ten to twenty-five in each ovisac, in one or two rows; inner gills the larger, free in part from the abdominal sac, or wholly united; mantle generally bordered behind with square, black spots; branchial opening with numerous papillæ; anal opening papillose or crenulate.

Type, *Andonta undulata* Say.

A small group of North American species, whose shells present no very striking characters. They are generally rather thin and present something the appearance of Anodontas, but have in all cases a hinge line incurved in front of the beaks, while in *Anodonta* it is straight or evenly curved in this region.

The presence of vestigial pseudocardinals distinguishes this group conchologically from *Anodonta*. But at the time that the embryos enter the outer gills a most remarkable transformation of these organs takes place. Instead of these embryos being contained in vertical or oblique ovisacs as they are in all the other known Naiades, they occupy short ovisacs that run horizontally across the gills; break through the outer walls of the gills and are discharged entire with their contents into the water. As soon as this has taken place the gills again assume the ordinary appearance of those organs in the Unionidæ.

KEY TO SPECIES OF STROPHITUS.

Shell smooth.

Shell rayless or only feebly rayed.

Rather solid, blackish or brownish. *S. edentulus.*

Rather thin, smoky-brown. *S. undulatus.*

Yellowish, tawny or greenish-yellow.
S. connasaugaensis, gesneri, alabamensis.

Shining, tawny or olive with dark bands. *S. spillmanii.*

Trapezoid, narrow in front, dark, dull colored.
S. tombigbeensis.

Shell rather brightly rayed.

Oblong oval. *S. edentulus pavonius.*

Widely biangulate behind. *S. undulatus quadriplicatus.*

Long rhomboid, truncate at anterior base. *S. radiatus.*

Shell plicate on dorsal slope.

Folds strong. *S. wrightianus.*

Folds delicate. *S. subvexus.*

STROPHITUS EDENTULUS (Say).

Shell long elliptical to long rhomboid, subinflated, subsolid, with moderately full, high beaks, whose sculpture consists of a few very coarse ridges, which run nearly parallel with the growth lines and turn up slightly behind; posterior ridge variable, generally angular; surface usually with strong, irregular, ridge-like growth lines; epidermis black or brownish, rayless or rayed, scarcely shining; hinge line generally rather

strong, somewhat curved in before the beaks and curved out behind them, having in each valve a sort of vestigial tooth placed in front of the beaks, that of the left valve usually most produced; laterals wanting or nearly so; beak cavities shallow; muscle scars large, slightly impressed; nacre white, bluish or salmon.

Length 115, height 65, diam. 38 mm.

Length 115, height 53, diam. 41 mm.

Length 90, height 50, diam. 30 mm.

Entire Mississippi drainage; St. Lawrence system and south in streams draining into the Atlantic to North Carolina; north in the British possessions to Lake Winnipeg; southwest to central Texas; Tyner, Alabama.

Type locality, Wabash River.

Alasmodonta edentula SAY, N. Harm. Diss., II, No. 22, 1829, p. 340.

Anodonta edentula FEBRUSSAC, Guer. Mag., 1835, p. 25.—CLESSIN, Conch. Cab. Ano., 1873, p. 107, pl. XXX, figs. 5, 6.

Margarita (Anodonta) edentula LEA, Syn., 1836, p. 50; 1838, p. 30.

Anodon edentula CATLOW and REEVE, Conch. Nom., 1845, p. 66.—DE KAY, Zool. N. Y., Pt. 5, 1848, p. 201, pl. XVI, fig. 231.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 95, fig. 174.

Uniopsis edentula AGASSIZ, Arch. für Nat., I, 1852, p. 49.

Margaron (Anodonta) edentula LEA, Syn., 1852, p. 49; 1870, p. 79.

Strophitus edentulus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 263.—BAKER, Moll. Chicago, Pt. I, 1898, p. 67, pl. XII, figs. 5, 6; XVII, fig. 3.—SIMPSON, Syn., 1900, p. 616.

Anodon rugosus SWAINSON, Zool. Ill., 1st ser., II, pl. XCVI, 1822.

Anodonta rugosus HANLEY, Biv. Shells, 1843, p. 217.

Strophitus rugosus DALL, Alaska, XIII, 1905, p. 127.

Anodonta undulata HILDRETH, Am. Jl. Sci., XIV, 1828, p. 290—CLESSIN, Conch. Cab. Ano., 1873, p. 79, pl. XXVII, figs. 3, 5.

Anodon undulata GOULD, Inv. of Mass., 1841, p. 120, fig. 79; 1870, p. 182, fig. 482.

Unio undulata DESHAYES, Tr. Elem., II, 1853, p. 217, pl. XXX, figs. 8, 9.

Anodon undulatus SOWERBY, Rich. Faun. Bor. Am., III, 1836, p. 316.—SOWERBY, Conch. Icon., XVII, 1867, pl. XI, fig. 30.

Anodon areolatus SWAINSON, Zool. Ill., 2d ser., I, 1829, pl. XVIII.

Anodonta areolatus FERUSSAC, Guer. Mag., 1835, p. 25.

Anodon marginata FERUSSAC, Guer. Mag., 1835, p. 25.

Anodonta ferussaciana FERUSSAC, Guer. Mag., 1835, p. 25.

Margarita (Anodonta) wardiana LEA, Syn., 1836, p. 50; 1838, p. 30.

Anodonta wardiana LEA, Tr. Am. Phil. Soc., VI, 1838, p. 46, pl. XIV, fig. 42; Obs., II, 1838, p. 46, pl. XIV, fig. 42.

Anodon wardiana SOWERBY, Conch. Icon., XVII, 1867, pl. XXVIII, fig. 114.

Margaron (Anodonta) wardiana LEA, Syn., 1852, p. 49; 1870, p. 79.

Anodonta virgata CONRAD, Cover of Mon., No. 5, 1836.

Strophitus virgatus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 263.

Anodon unadilla DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 199, pl. XV, fig. 228.

Strophitus unadilla CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 263.

Anodonta tetragona LEA, Pr. Am. Phil. Soc., IV, 1845, p. 165; Tr. Am. Phil. Soc., X, 1848, p. 82, pl. VIII, fig. 25; Obs., IV, 1848, p. 56, pl. VIII, fig. 25.

Margaron (Anodonta) tetragona LEA, Syn., 1852, p. 51; 1870, p. 81.

Strophitus tetragona CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 263.

Anodonta arkansasensis LEA, Tr. Am. Phil. Soc., XI, 1852, p. 293, pl. XXIX, fig. 56; Obs., V, 1852, p. 49, pl. XXIX, fig. 56.

Margaron (Anodonta) arkansasensis LEA, Syn., 1852, p. 50; 1870, p. 80.

Strophitus arkansasensis CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 262.

Anodonta shæfferiana LEA, Tr. Am. Phil. Soc., X, 1852, p. 288, pl. XXVI, fig. 50; Obs., V, 1852, p. 44, pl. XXVI, fig. 50.

Margaron (Anodonta) shæfferiana LEA, Syn., 1852, p. 51; 1870, p. 81.

Strophitus schæfferiana CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 263.

Anodonta shefferiana CLESSIN, Conch. Cab. Ano., 1873, p. 243, pl. XVII, figs. 5-7.

Anodonta shafferiana B. H. WRIGHT, Check List, 1888.

Anodon shæfferianus SOWERBY, Conch. Icon., XVII, 1870, pl. XXXV, fig. 143.

Alasmodon rhombica ANTHONY, Am. Jl. Conch., I, 1865, p. 158, pl. XII, fig. 5.

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

Anodonta salmonea CLESSIN, Conch. Cab. Ano., 1873, p. 91, pl. XXIV, figs. 1, 2.

Var. *pavonius* (Lea).

Shell generally long elliptical; epidermis yellowish-green, more or less covered with darker green or brownish-green rays.

Indiana; Ohio.

Type locality, headwaters of the Little Beaver, Ohio.

Anodonta pavonia LEA, Tr. Am. Phil. Soc., VI, 1836, p. 78, pl. XXI, fig. 65; Obs., II, 1838, p. 78, pl. XXI, fig. 65.—MUSGROVE, Phot. Conch., 1863, pl. I, fig. 9.—CLESSIN, Conch. Cab. Ano., 1873, p. 156, pl. XXX, figs. 3, 4.

Margarita (Anodonta) pavonia LEA, Syn., 1838, p. 30.

Anodon pavonia DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 203, pl. XL, fig. 358.—SOWERBY, Conch. Icon., XVII, 1870, pl. XXXII, fig. 128.

Margaron (Anodonta) pavonia LEA, Syn., 1852, p. 50; 1870, p. 79.

Strophitus pavonius BAKER, Moll. Chicago, Pt. I, 1898, p. 68, pl. III, fig. 5; V, fig. 3.

Strophitus edentulus var. *pavonius* SIMPSON, Syn., 1900, p. 617.
Anodon annulatus SOWERBY, Conch. Icon., XVII, 1867, pl. XVIII, fig. 67.

An almost infinitely variable species as to size, solidity and form. Specimens from Tennessee are decidedly rhomboid, rather compressed, and light brown-colored, others from the St. Lawrence drainage are quite small and reddish or lurid brown. One of these from the Maumee basin, which seems to be mature, measures 35 millimeters long, 20 high, and 12 in diameter. Some of the old shells become very solid, other forms are thin and fragile. The form I have called variety *pavonius* is hardly worth a separate name, as there is a great deal of material varying all the way from rayless to brightly rayed.

STROPHITUS UNDULATUS (Say).

Shell generally subrhomboid, scarcely inflated, rather thin, inequilateral, with high beaks, whose sculpture consists of a few very strong ridges running parallel with the growth lines, turning up somewhat behind; behind these there are usually a few radial liræ; posterior ridge generally well developed and angular, sometimes double; surface with fine growth lines; epidermis dull ashy, ashy-green or smoky, often with faint, darker rays; hinge line narrow, somewhat incurved in front of the beak, having the merest vestiges of pseudocardinals and no laterals; beak cavities not deep; nacre bluish, often straw-colored, buff or pale salmon in the shell cavities.

Length 63, height 37, diam. 23 mm.

Length 30, height 20, diam. 12 mm.

Northern New England to Virginia, in streams draining into the Atlantic. This species is reported from Manitoba, but it is probable that the specimens from that region are *S. edentulus*.

Type locality not given.

Anodonta undulata SAY, Nich. Enc., II, 1817, pl. III, fig. 5.
Margarita (Anodonta) undulata LEA, Syn., 1836, p. 50; 1838, p. 30.

Anodon undulata CATLOW and REEVE, Conch. Nom., 1845, p. 68.

Alasmodonta undulata C. B. ADAMS, Thompson's Hist. Vt., 1842, p. 165.

Margaron (Anodonta) undulata LEA, Syn., 1852, p. 49; 1870, p. 79.

Strophitus undulatus STIMPSON, Shells of N. Eng., 1851, p. 15. —SIMPSON, Syn., 1900, p. 618.

Anodonta pennsylvanica LAMARCK, An. sans Vert., VI, 1819, p. 86.—DELESSERT, Rec. Coq. Lam., 1841, pl. XIII, figs. 4*a*, 4*b*.—CHENU, Ill. Conch., 1858, pl. III, figs. 5, 5*a*.

Anodon papyraceus ANTHONY, Am. Jl. Conch., I, 1865, p. 161, pl. XV, fig. 2.—SOWERBY, Conch. Icon., XVII, 1867, pl. XIV, fig. 46.

Anodonta papyracea B. H. WRIGHT, Check List, 1888.

Margaron (Anodonta) papyracea LEA, Syn., 1870, p. 81.

Var. *quadriplicatus* (Sowerby).

Shell rather more elongated than the type, more distinctly and widely biangulate behind and usually quite plainly rayed. Type locality, Potomac River.

Anodon quadriplicatus SOWERBY, Conch. Icon., XVII, 1867, pl. XXVIII, fig. 110.

Some specimens of this variety are so distinct that they almost seem worthy of specific rank, being quite elongated, strongly and widely biangulate behind, and decidedly rayed. But there is a great variety of intermediate material. Say's figure of *A. undulata* represents a young or extremely small shell, but I feel no hesitation in identifying it with the rather common *Strophitus* found in the Atlantic system of drainage. It is thinner than the usual manifestation of *edentulus*, generally smaller, more rhomboid, *and having a smoky-brown epidermis typically*. The nacre is usually bluish, especially around the border of the shell. So far as I know the *S. undulatus* and its variety are confined to the Atlantic and St. Lawrence drainage systems, while *S. edentulus* belongs in this territory and a large part of the Mississippi area.

STROPHITUS CONNASAUGAENSIS (Lea).

Shell thin or scarcely subsolid, elongated, subrhomboid, often narrower in front, subinflated, inequilateral, with full, moderately high beaks, whose sculpture consists of a few very strong ridges running parallel with the growth lines and somewhat interrupted at the posterior ridge; posterior ridge full but widely-rounded; surface with irregular growth lines and more or less developed concentric ridges; epidermis yellowish-green, with occasional feeble indications of rays, these being mostly developed at the posterior end; in each valve there is an irregular, subcompressed tooth under or in front of the beak; laterals wanting; beak cavities moderate; muscle scars rather large, slightly impressed; nacre bluish, shaded with flesh-color in older shells.

Length 63, height 36, diam. 23 mm.

Alabama River system.

Connasauga River, Gilmer County, Georgia.

Margaritana connasaugaensis LEA, Pr. Ac. N. Sci. Phila., II, 1857, p. 135; Jl. Ac. N. Sci. Phila., IV, 1859, p. 229, pl. XXXII, fig. 113; Obs., VII, 1859, p. 47, pl. XXXII, fig. 113.

Margaron (Margaritana) connasaugaensis LEA, Syn., 1870, p. 69.

Unio connasaughensis SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXVIII, fig. 474.

Margaritana connesaugensis CLESSIN, Conch. Cab. Ano., 1875, p. 269, pl. LXXXI, figs. 7, 8.

Strophitus connasaugaensis SIMPSON, Syn., 1900, p. 618.

In the Synopsis I placed the *Margaritana alabamensis* of Lea in the synonymy of the above. What little material I have been able to examine of this group is puzzling, variable and unsatisfactory. Lea has placed in his *Margaritana holstonia* specimens, which I think are his *M. alabamensis*.

STROPHITUS ALABAMENSIS (Lea).

Shell subrhomboid, somewhat elongated, scarcely inflated, inequilateral, thin to subsolid; beaks moderately full and elevated, their sculpture consisting of a few strong ridges run-

ning parallel to the growth lines; posterior ridge full but widely rounded; surface with irregular concentric sculpture; epidermis varying from yellowish-green to pale dirty olive, often showing a few feeble rays behind, subshining; left valve with a single feeble, somewhat stumpy, smooth tooth; right valve with one and sometimes a faint second pseudocardinal, which are often slightly compressed; muscle scars shallow; nacre dull, usually tinted with purple.

Length 105, height 54, diam. 35 mm.

Type locality, Talladega Creek, Alabama. Also, Shelby County, Alabama.

Margaritana alabamensis LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 41; Jl. Ac. N. Sci. Phila., V, 1862, p. 104, pl. XVI, fig. 249; Obs., VIII, 1862, p. 108, pl. XVI, fig. 249.—CLESSIN, Conch. Cab. Ano., 1876, p. 264, pl. LXXX, fig. 5.

Unio alabamensis SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXII, fig. 433.

Margaron (Margaritana) alabamensis LEA, Syn., 1870, p. 68.

Strophitus connasaugaensis, (part), SIMPSON, Syn., 1900, p. 618.

I confess that this form and the *Margaritana connasaugaensis* and *M. gesnerii* Lea are quite puzzling. Unfortunately I have been able to examine but little material belonging to the group, and I am not at all sure but what all three are forms of one and the same thing. The examples of *gesnerii*, which I have seen, have rather strong, concentric sculpture. The only certainly authentic *connasaugaensis* I have seen is the type, a young shell, which is narrow in front, has an unusually high rounded posterior ridge and is dull greenish-yellow with a few faint rays behind. The type of *alabamensis* is subsolid, and rhomboid, is subshining and has a purplish-tinted nacre

STROPHITUS SPILLMANII (Lea).

Shell elliptic rhomboid, subsolid, inflated, inequilateral, with full, high beaks and a full, but widely rounded, posterior ridge; beak sculpture a few very strong, concentric ridges; anterior

end slightly narrowed; surface with irregular concentric ridges; epidermis smooth and shining, dark tawny or olive, with wide, ill-defined, dark brown, concentric bands; hinge with an imperfect, compressed tooth in each valve just in front of the beaks, with no laterals; beak cavities rather deep but not compressed; nacre flesh-white; muscle scars shallow.

Length 80, height 46, diam. 33 mm.

Length 90, height 50, diam. 38 mm.

Tombigbee River, Mississippi.

Type locality, Tombigbee River, Columbus, Miss.

Margaritana spillmanii LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 138; Jl. Ac. N. Sci. Phila., V, 1862, p. 105, pl. XVII, fig. 252; Obs., VIII, 1862, p. 109, pl. XVII, fig. 252.—CLESSIN, Conch. Cab. Ano., 1876, p. 264, pl. LXXXII, figs. 5, 6.

Unio spillmanii SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXII, fig. 435.

Margaron (Margaritana) spillmanii LEA, Syn., 1870, p. 69.

Strophitus spillmanii SIMPSON, Syn., 1900, p. 619.

The greatest diameter is at or just behind the middle of the shell. This species differs from *S. connasaugaensis* in being rather solider, more glossy, and much darker, and in the peculiar banding of the color. The nacre is cleaner and not tinged with blue. It is longer than *S. tombigbeensis* and smoother.

STROPHITUS TOMBIGBEENSIS (Lea).

Shell irregularly trapezoidal, much narrowed in front, the hinge line incurved in front and rounded out behind, inflated, scarcely subsolid, with full, high beaks, whose sculpture has not been observed; posterior end obliquely subtruncate above or somewhat rounded, terminating in a point near the hinder base of the shell at the lower end of the high, rather angular posterior ridge; surface with irregular, often subsulcate growth lines; epidermis generally dark olive-green, sometimes with a few lighter green rays and these may be interspersed with pale greenish-yellow rays, not shining; hinge with a very rudimentary tooth in front of the beaks in each valve; beak

cavities somewhat deep, not compressed; muscle scars shallow: nacre bluish or bluish-white, sometimes flesh-colored and blotched in the cavities of the valves.

Length 77, height 52, diam. 37 mm.

Tombigbee River Mississippi.

Type locality, Tombigbee River, Columbus, Miss.

Margaritana tombecbeensis LEA, Pr. Ac. N. Sci., Phila., II, 1858, p. 138.

Margaritana tombigbeensis LEA, Jl. Ac. N. Sci. Phila., V, 1862, p. 107, pl. XVIII, fig. 255; Obs., VIII, 1862, p. 111, pl. XVIII, fig. 255.

Margaron (Margaritana) tombigbeensis LEA, Syn., 1870, p. 68.

Margaritana (Alasmodonta) tombigbeensis CLESSIN, Conch. Cab. Ano., 1876, p. 268, pl. LXXXI, figs. 3, 4.

Strophitus tombigbeensis SIMPSON, Syn., 1900, p. 619.

Margaritana columbensis LEA, Pr. Ac. N. Sci. Phila., XI, 1867, p. 81.—Index, II, 1869, p. 23.—SIMPSON, Syn., 1900, p. 673.

In this species the distinguishing characters are the peculiar dark, rather dull epidermis with a few narrow, nearly yellow rays, and sometimes with a few bright green ones, a most peculiar pattern of coloring. The hinge line is rather more curved than it is in either *S. connasaugaensis* or *S. spillmanii*. It resembles to some extent certain specimens of *S. edentulus*, but is a rather shorter species.

STROPHITUS GESNERII (Lea).

Shell somewhat elongated, subrhomboid, with the dorsal and ventral lines nearly parallel, scarcely subsolid, somewhat inflated; beaks probably rather full and high, but much eroded in the specimens examined, placed somewhat in front of the middle; posterior ridge moderate, very slightly double; surface covered with irregular, low sulcations; epidermis pale greenish-brown, rayless or very faintly rayed; left valve with two or three low, vestigial pseudocardinals; right valve with one low pseudocardinal; laterals nearly or quite wanting;

beak cavities not deep; muscle scars shallow; nacre dull, tinted purplish, slightly thicker in front.

Length 92, height 55, diam. 37 mm.

Length 87, height 50, diam. 32 mm.

Type locality, Uphaupee Creek, Ala. Also Swamp Creek, Alabama.

Margaritana gesnerii LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 138; Jl. Ac. N. Sci. Phila., V, 1862, p. 211, pl. XXXII, fig. 280; Obs., IX, 1863, p. 33, pl. XXXII, fig. 280.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIV, fig. 446.

Margaron (Margaritana) gesnerii LEA, Syn., 1870, p. 67.

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

Strophitus gesnerii SIMPSON, Syn., 1900, p. 619.

This species resembles *S. connasaugaensis* somewhat in external appearance, but it is more strongly sulcate and the teeth are quite different. In that species there is a strong, single tooth; in this there are two or three low vestigial ones in the left valve and a single low one in the right. I am not positive as to the generic position of this form. I have only seen two rather badly eroded shells, the type and another specimen from Uphaupee Creek. It may not be a *Strophitus*, but I do not know where else to place it.

STROPHITUS SUBVEXUS (Conrad).

"Shell suboval, inflated; thin; anterior end rounded; posterior end subtruncated; posterior dorsal margin elevated and abruptly rounded at the extremity; callus resembling an incipient tooth.

Shell suboval, inflated, thin, with prominent beaks, undulated at the apex and not distant from the middle of the valve; umbo inflated; umbonal region angulated, and the space behind with radiating lines; epidermis olive and rather obscurely rayed; cavity very capacious, most so behind the middle; nacre bluish, stained with a light waxen-yellow.

Length about 2 inches." (Conrad).

Type locality, Black Warrior River, Ala.

Anodonta subvexa CONRAD, Am. Jl. Sci., XXV, 1834, p. 341, pl. 1, fig. 1.

Margarita (Anodonta) subvexa LEA, Syn., 1836, p. 52; 1838, p. 31.

Anodon subvexa CATLOW and REEVE, Conch. Nom., 1845, p. 68.

Margaron (Anodonta) subvexa LEA, Syn., 1852, p. 50; 1870, p. 81.

Lampsilis subvexa SIMPSON, Syn., 1900, p. 533.

In the Synopsis, I placed this species in *Lampsilis* with great hesitation. Since then I have seen additional material that has convinced me that it is a valid species of *Strophitus*.

STROPHITUS RADIATUS (Conrad).

"Shell ovate-acute, ventricose; posterior end produced and pointed at the end; cardinal tooth in the right valve elongated and anterior to, and distant from the beak; cardinal tooth in the left valve elongated, and situated immediately under the beak. Shell ovate-acute, ventricose, with the posterior side produced and pointed at the end; beaks prominent and pointed at the apex, which has two or three profound undulations; epidermis light olive, beautifully rayed with dark green; cavity capacious; nacre waxen-yellowish." (Conrad).

Length 2.5 inches.

Type locality, small streams in South Alabama.

Alasmodonta radiata CONRAD, Am. Jl. Sci., XXV, 1834, p. 341, pl. 1, fig. 10.

Margarita (Margaritana) radiata LEA, Syn., 1836, p. 44; 1838, p. 27.

Margaron (Margaritana) radiata LEA, Syn., 1852, p. 43; 1870, p. 68.

Strophitus radiatus CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 263.

? Strophitus radiatus SIMPSON, Syn., 1900, p. 620.

I cannot give a guess as to what this is or where it really belongs. The figure is rather poor, representing a shell with an upper anterior angle, the front end somewhat pointed a short distance below this angle, and the anterior base of the

shell somewhat cut away. The posterior end is very slightly pointed about midway up from the base. The description given by its author of the teeth and beaks might indicate that it was a *Strophitus*, and Conrad places it in this group in his Synopsis of 1853.

Section JUGOSUS n. sec.

Shell with the dorsal slope strongly subradially plicate; teeth unusually strong.

Type, *Strophitus wrightianus* Walker.

STROPHITUS WRIGHTIANUS Walker.

Shell irregular, subrhomboid, inflated, scarcely subsolid, nearly equilateral, gaping in front; beaks very full and high, turned in over a slight lunule, their sculpture consisting of a few strong ridges, which seem to run nearly parallel with the growth lines; anterior end rounded, cut away a very little below; base line evenly curved; outline of dorsal slope strongly and evenly curved; posterior ridge high, angled, ending in a blunt point below the median line of the shell; dorsal slope subtruncate, covered with strong, subradial, curved, somewhat broken ridges; disk with light, uneven growth lines; epidermis delicately, concentrically wrinkled, almost jet black, lighter at the umbones, shining; left valve with an irregular tooth under the beak and a vestigial one in front of the beak; right valve with a roughened tooth in front of the beak; laterals almost wanting; beak cavities deep; anterior muscle scars distinct; posterior scars faint; nacre bluish with a milky tint, a little thicker in front.

Length 54, height 38, diam. 30.5 mm.

Type locality, Ochlochnee River, Florida.

Strophitus wrightianus WALKER, Naut. XV, 1901, p. 65, pl. III.

I cannot be certain as to the generic position of this species without an examination of the animal. The general appearance of the shell would indicate that it was a *Strophitus* allied to *S. tombigbeensis*, but it differs from that of any other spe-

cies in the strong folds of the dorsal slope and the fairly well developed pseudocardinals. I am informed by Mr. Walker that the locality given in the original description was erroneous. The one now stated is correct.

HOMOGENÆ.

Male and female shells alike, oval to elongate; beak sculpture generally coarse; embryos filling the entire outer gills in the form of thick, smooth pads; the ovisacs not separated by sulci.

Genus ANODONTA Lamarck, 1799.

Mya Linnæus, part, Syst. Nat., 1758, p. 1158.

Limnæa Poli Test. Utriusque Sic., I, 1791, p. 31; II, 1795, p. 253.

Anodonta Lamarck, Prodrome Class, Coq., 1799, p. 87.—Ortmann, Ann. Car. Mus., VIII, 1912, p. 286.

Anodon Oken, Lehrb. Nat. Zool., I, 1815, p. 238.

Anodontes Cuvier, Regne, An., II, 1817, p. 472.

Pseudanodonta Bourguignat, Bull. Soc. Sci. Bordeaux, 1876, p. 99.

Pteranodon Fischer, Man. Conch., 1887, p. 1005.

Shell elliptical, inflated, often slightly winged posteriorly; beak sculpture consisting of rather numerous more or less parallel ridges, usually somewhat doubly looped and becoming slightly nodulous on the loops; surface generally smooth, shining; hinge edentulous, reduced to a mere line, regularly curved; muscle scars rather faint; nacre dull.

Animal with the marsupium occupying the whole outer gills, when filled forming a smooth, very thick, liver-colored pad; gills free from the abdominal sac from one-half to their entire length; palpi generally large; branchial opening papillose; anal opening without papillæ, though sometimes very slightly crenulate; superanal opening generally small, widely separated from the anal

Type, *Mytilus cygneus* Linnæus.

The genus *Anodonta* as here restricted consists of Naiades with generally thin, edentulous shells having a straight or

evenly curved, narrow hinge line, *which is never incurved in front of the beaks.* The marsupium occupies the entire outer gills, forming thick, smooth, generally dark colored, pads. The genus is distributed throughout all or nearly all of North America and the Palæarctic region, and is quite abundant in the northern part of the Oriental region. Fischer made the subgenus *Pteranodon,* founded on these oriental forms, but I see no reason for giving them a higher rank than that of a group. I have examined the gravid females of specimens of these oriental forms and they scarcely differ from those of the Palæarctic or American species. The forms I have placed in *Strophitus* and *Anodontoides* differ from the true Anodontas in beak sculpture, in having rudimentary teeth *and in having the hinge line incurved in front of the beaks.* There are also differences in the anatomy, which are quite important.

Group of *Anodonta cygnea.*

Shell very evenly rounded in front, pointed behind, the point elevated above the base, more or less winged on postdorsal part, the line from the posterior part of the wing to the hinder point usually incurved; beaks flattened, the sculpture consisting of numerous more or less concentric ridges, which are sometimes broken up into rather irregular corrugations.

Animal having the inner gills the larger, free from the abdominal sac nearly or quite their whole length; palpi large.

ANODONTA CYGNEA (Linnæus).

Shell long elliptical, oval or subrhomboid, thin or somewhat subsolid, moderately inflated, inequilateral, the beaks and the area near them normally compressed; in some forms the beaks are rather full but never high nor sharp; their sculpture consists of numerous, rather closely set, fine, low ridges, which either follow the growth lines or are slightly corrugated, this sculpture extends well out on the shell; anterior end evenly curved from the region of the beaks around to the base; behind the beaks there is usually a more or less developed dor-

sal wing, which, however, never rises to a great height; there is an angle at the posterior end of the wing and from this point the shell is obliquely truncate, the upper outline of the posterior slope being often slightly incurved. Posterior ridge generally low, more or less double, and, when double, it ends in a biangulation at some distance above the base line; base line curved, or rarely straight; growth lines irregular, sometimes forming low ridges; epidermis more or less shining, yellowish-green, ash-colored or olive, very often having wide, faint bands of darker color, and occasionally feebly rayed; hinge line widened a little behind the beaks, narrow at or in front of them, edentulous; escutcheon small; nacre whitish, sometimes tinted dull purplish in the cavities; beak cavities shallow, showing a few irregular dorsal scars; muscle scars large, superficial.

Length 180, height 86, diam. 50 mm.

Length 138, height 76, diam. 44 mm.

Length 135, height 86, diam. 47 mm.

Europe generally; Siberia; southward, perhaps, into Asia Minor. It has been reported from the Amoor River drainage, but I presume that the specimens from that region belong to the group of *A. woodiana*.

Mytilus cygneus LINNÆUS, Syst. Nat., 10th ed., 1758, I, p. 706, No. 1158.—DA COSTA, Hist. Nat. Test. Brit., 1778, p. 214, pl. XV, fig. 2.—SCHRÖTER, Flussconch., 1779, p. 162, pl. III, fig. 1.—DONOVAN, Brit. Shells, II, 1800, pl. LV.—MATON and RACKETT, Tr. Linn. Soc. Lond., VIII, 1807, p. 109, pl. III, figs. 2, 3.—SHEPPARD, Tr. Linn. Soc. Lond., XIII, 1820, p. 84, pl. V, fig. 3.—WOOD, Ind. Test., 1825, p. 58, pl. XII, fig. 32*f*; Ind. Test. Rev., 1856, p. 69, pl. XII, fig. 32*f*.

Anodontes cygneus CUVIER, Regne An., II, 1817, p. 472.

Anodon cygneus TURTON, Conch. Ins. Brit., 1822, p. 239; Man. L. and F. W. Shells, 1831, p. 17, fig. 8.—BROWN, Land and F. W. Conch., 1836, p. 99, pl. XI, figs. 1-3*c*; Ill. Rec. Conch., 1844, p. 79, pl. XXVIII, etc.—TURTON, Man. L. and F. W. Shells, 1857, p. 271, fig. 65; pl. I, fig. 8.—TATE, L. and F. W. Moll. Brit., 1866, pl. I.—SOWERBY, Conch. Icon., XVII, 1870, pl. I, fig. 2.

Anodonta cygnea DRAPARNAUD, Hist. Moll. Fr., 1806, p. 134, pl. XII, fig. 1; pl. XI, fig. 6.—BRARD, Hist. Coq. Paris, 1815, p. 234, pls. IX, X.—C. PFEIFFER, L. and S. Moll., 1821, Pt. 1, p. 111, pl. V, fig. 4.—BLAINVILLE, Man., 1825, p. 358, pl. LXVI, fig. 1.—GUERIN, Icon. Regne An., II, 1829, pl. XXVIII, fig. 5. —ROSSMASSLER, Icon., I, 1835, p. 111, pl. III, fig. 67, etc.— WYATT, Man. Conch., 1838, p. 68, pl. XI, fig. 2.—GRAS, Moll. Isere, 1840, p. 70, pl. VI, fig. 7.—DROUET, Nay. Fr., 1852, p. 5, pl. 1.—DUPUY, Hist. Moll. Fr., 1852, p. 601, pl. XV, fig. 14.—FORBES and HANLEY, Hist. Brit. Moll., II, 1853, p. 155, pl. XXXIX, fig. 3; XL, figs. 2, 3; XLI.—KUSTER, Conch. Cab. Ano., 1853, p. 58, pl. XV.—MOQUIN-TANDON, Moll. Fr., II, 1855, p. 557, pl. XLIV.—NORDENSKIÖLD and NYLANDER, Fin. Moll., 1856, p. 90, pl. VII, fig. 78.—H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 502; III, pl. CXVIII, figs. 1, 1*a*, 1*b*.— CHENU, Man., 1859, II, p. 145, fig. 718.—SOWERBY, Ill. Index Brit. Shells, 1859, pl. VII, No. 4.—REEVE, Elements of Conch., II, 1860, pl. P, No. 4; L. and F. W. Moll. Br., 1863, p. 215, fig. 1.—HOUGHTON, Int. Obs., 1864, p. 68, pl. 1, figs. 1, 2.—BROT, Etudes Nayades, Leman, 1867, p. 28, pl. 1, fig. 1; pl. II, figs. 1, 2.—SIMPSON, Syn., 1900, p. 621.—ORTMANN, Ann Car. Mus., VIII, 1912, p. 286, figs. 13-13*a*.

Symphynota cygnea LEA, Tr. Am. Phil. Soc., 1830, p. 456; Obs., I, 1834, p. 70.

Margarita (Anodonta) cygnea LEA, Syn., 1836, p. 48; 1838, p. 29.

Anodon cygnea CROUCH, Ill. Int. Lam., 1827, pl. IX, fig. 6.

Margaron (Anodonta) cygnea LEA, Syn., 1852, p. 47; 1870, p. 76.

Anodonta cygnæa GASSIES, Moll. Ag., 1849, p. 189.

Anodonta radiatus MULLER, Vermium, 1774, p. 209.

Mytilus zellensis GMELIN, Syst. Nat., 13th ed., I, 1788, p. 3262.

Anodonta zellensis WAARDENBERG, Hist. Nat. An., 1827, p. 37.

Anodonta cellensis C. PFEIFFER, Deuts. L. and Suss. Moll., I, 1821, p. 110, pl. VI, fig. 1.—ROSSMASSLER, Icon., IV, 1836, p. 22, pl. XIX, fig. 280.—STABILE, Faun. Lug., 1845, p. 58, pl.

II, fig. 69.—DUPUY, Nay. Fr., 1852, p. 11, pl. II.—KUSTER, Conch. Cab. Ano., 1853, p. 16, pl. IV, fig. 3; V, figs. 1-4; VI, fig. 1.—BROT, Coq. Leman, 1867, p. 33, pl. III, figs. 1-3; IV, figs. 1, 2; VI, fig. 4.

Anodonta variabilis DRAPARNAUD, Tab. Moll. Fr., 1801, p. 108.

Mytilus avonensis MONTAGU, Test. Brit., 1803, p. 172.—WOOD, Ind. Test. Rev., 1856, p. 69, pl. XII, fig. 34.

Anodon avonensis, TURTON, Conch. Ins. Brit., 1822, p. 211.

Anodonta avonensis MOQUIN-TANDON, Moll. France, II, 1855, p. 362, pl. XLVI, figs. 7, 8.

Mytilus avoensis TURTON, Brit. Faun., 1807, p. 165.

Mytilus stagnalis TURTON, Brit. Faun., 1807, p. 165.

Anodonta stagnalis BOSC, Hist. Nat. Coq., III, 1824, p. 143.

Mytilus fucatus DILLWYN, Cat. I, 1817, p. 317.

Anodonta sulcata LAMARCK, An. sans Vert., VI, 1819, p. 85.—DESHAYES, Enc. Meth., II, 1827, p. 147, pl. CCII.

Anodonta intermedia LAMARCK, An. sans Vert., VI, 1819, p. 86.—C. PFEIFFER, Deuts. L. and S. Moll., 1821, Pt. 1, p. 113, pl. VI, fig. 3.—DESHAYES, Enc. Meth., II, 1827, p. 147, pl. CCI, fig. 2.

Anodon intermedia CATLOW and REEVE, Conch. Nom., 1845, p. 67.

Anodon intermedius KENYON, Mag. Nat. Hist., I, 1829, p. 426, fig. 185.

Mytilus incrassatus SHEPPARD, Tr. Linn. Soc. Lond., XIII, 1820, p. 85, pl. V, fig. 4.

Anodonta incrassata LOCARD, Coq. de Fr., 1893, p. 260.

Mytilus macula SHEPPARD, Tr. Linn. Soc. Lond., XIII, 1820, p. 86, pl. V, fig. 6.

Anodon paludosus TURTON, Conch. Ins. Brit., 1822, p. 240, pl. XV, fig. 6.

Anodonta ventricosa C. PFEIFFER, Deuts. L. and Suss. Moll., Pt. 2, 1825, p. 30, pl. III, figs. 1-6.—KUSTER, Conch. Cab. Ano., 1853, p. 56, pl. XI, figs. 3-5.

Anodonta minima MILLET, Mem. Soc. Ag. Aug., 1833, p. 241, pl. XII, fig. 2.—DUPUY, Hist. Moll. Fr., 1852, p. 611, pl. XX, fig. 20.

Anodonta oblonga Millet, Mem. Soc. Ag. Aug., 1833, p. 242, pl. XII, fig. 1.—Drouet, Hist. Moll. Fr., 1852, p. 65, pl. XVIII, fig. 13.

Anodon oblongus Sowerby, Conch. Icon., XVII, 1867, pl. XV, fig. 54.

Anodonta attenuata Held, Isis, 1836, p. 280.

Anodonta exulcerata Porro, Mal. Como., 1838, p. 111, pl. II, fig. 12.—Sowerby, Conch. Icon., XVII, 1870, pl. XXXIII, fig. 131.—Clessin, Conch. Cab. Ano., 1874, p. 127, pl. XL, figs. 3, 4.

Anodonta coarctata Potiez and Michaud, Gall. Moll., 1844, p. 142, pl. LV, fig. 2.—Dupuy, Hist. Moll. Fr., 1852, p. 616, pl. XX, fig. 51.

Anodonta elongata Potiez and Michaud, Gall. Moll., 1844, p. 141, pl. LV, fig. 1.—Dupuy, Hist. Moll. Fr., 1852, p. 620, pl. XVI, fig. 16.

Anodonta glabra Stabile, Faun. Lug., 1845, p. 58, pl. II, fig. 68.

Anodonta lusitana Morelet, Moll. Port., 1845, p. 103, pl. XII, fig. 1.—Clessin, Conch. Cab. Ano., 1873, p. 85, pl. XXIII, fig. 1.

Anodonta regularis Morelet, Moll. Port., 1845, p. 100, pl. X. —Clessin, Conch. Cab. Ano., 1873, p. 85, pl. XXIII, fig. 2.

Anodonta macilenta Morelet, Moll. Port., 1845, p. 102.—Clessin, Conch. Cab. Ano., 1873, p. 87, pl. XXIV, fig. 2.

Anodonta ranarum Morelet, Moll. Port., 1845, p. 104, pl. XII, fig. 2.—Clessin, Conch. Cab. Ano., 1873, p. 86, pl. XXIII, fig. 3.

Anodonta atrovirens Philippi, Menke's Zeits., 1848, p. 130.—Sowerby, Conch. Icon., XVII, 1867, pl. XIII, fig. 41.

Anodonta milletii Ray and Drouet, Rev. Zool., 1848, p. 3, pl. I, figs. 1-2.—Dupuy, Hist. Moll. Fr., 1852, p. 617, pl. XXI, fig. 16.

Anodonta grateloupiana Gassies, Moll. Agenais, 1849, p. 193, pl. II, figs. 13-15; pl. III, fig. 1B; pl. IV, fig. 2.

Pseudanodonta grateloupiana Bourguignat, Mat. Moll. Aceph. I, 1881, p. 29.

Anodonta dupuyi Ray and Drouet, Rev. Zool., 1849, p. 32, pls. I, II.—Drouet, Rev. et Mag., 1849, p. 11, pl. II, figs. 1-2; Nay. Fr., 1852, pl. VII.—Dupuy, Hist. Moll. Fr., 1852, p. 606, pl. XVII, fig. 13.

Anodonta rayi Drouet, Cat. Extram., 1849, No. 35.—Dupuy, Hist. Moll. Fr., 1852, p. 614, pl. XX, fig. 22.—Sowerby, Conch. Icon., XVII, 1867, pl. XIX, fig. 72.

Anodonta idrina Spinelli, Cat. Moll. Bresc., 1851, p. 19, pl. I, fig. 1.—Clessin, Conch. Cab. Ano., 1875, p. 167, pl. LV, figs. 1, 2.—Kobelt, Icon., IV, 1876, p. 67, pl. CXX, figs. 1156-1159.—Clessin, Moll. Oest., 1887, p. 712, fig. 484.

Anodonta arelatensis Dupuy, Hist. Moll. Fr., 1852, p. 611, pl. XIX, fig. 14.

Anodontites europæ Leach, Syn. Moll. Gt. Br., 1852, p. 326.

Anodonta moulinsiana Dupuy, Hist. Moll. Fr., 1852, p. 614, pl. XX, fig. 19.—Kobelt, Icon., VI, 1879, p. 45, pl. CLXV, fig. 1055.

Anodonta normandi Dupuy, Hist. Moll. Fr., 1852, p. 620, pl. XVI, fig. 15.—Sowerby, Conch. Icon., XVII, 1870, pl. XXVIII, fig. 109.

Anodonta parvula Drouet, Nay. Fr., No. 5, 1852, p. 9, pl. IV, fig. 2.

Anodonta rossmassleriana Dupuy, Hist. Moll. Fr., 1852, p. 608, pl. XVIII, fig. 14.

Anodonta subponderosa Dupuy, Hist. Moll. Fr., 1852, p. 607, pl. XVII, fig. 14.

Anodonta tenella Kuster, Conch. Cab. Ano., 1852, p. 63, pl. IX, fig. 5.

Anodonta scaldiana Dupuy, Hist. Moll. Fr., 1852, p. 613, pl. XIX, fig. 12.—Kobelt, Icon., VII, 1880, p. 35, CXCIV, fig. 1960.

Anodonta luxata Kuster, Conch. Cab. Ano., 1853, p. 9, pl. III, fig. 1.

Anodonta callosa Kuster, Conch. Cab. Ano., 1853, p. 36, pl. IX, fig. 1.

Anodonta cariosa Kuster, Conch. Cab. Ano., 1853, p. 43, pl. IV, fig. 3; V, fig. 1; X, figs. 1, 2.

Anodonta arealis KUSTER, Conch. Cab. Ano., 1853, p. 47, pl. IX, figs. 2-4.

Anodonta charpentieri KUSTER, Conch. Cab. Ano., 1853, p. 49, pl. XI, figs. 3, 4.—SOWERBY, Conch. Icon., XVII, 1867, pl. XII, fig. 37.

Anodonta anserirostris KUSTER, Conch. Cab. Ano., 1853, p. 55, pl. X, fig. 3; XI, figs. 1, 2.

Anodonta inornata KUSTER, Conch. Cab. Ano., 1853, p. 42, pl. III, fig. 6.

Anodonta tumida KUSTER, Conch. Cab. Ano., 1853, p. 48, pl. XII, figs. 1, 2.

Anodonta subluxata KUSTER, Conch. Cab. Ano., 1853, p. 52, pl. XIII, figs. 1, 2.

Anodonta sondermannii KUSTER, Conch. Cab. Ano., 1853, p. 54, pl. XIII, fig. 4.

Anodonta opalina KUSTER, part, Conch. Cab. Ano., 1853, p. 60, pl. XVI, figs. 1, 2.

Anodonta nilssonii KUSTER, part, Conch. Cab. Ano., 1853, p. 61, pl. XVIII, fig. 2.

Anodonta helvetica BOURGUIGNAT, Rev. et Mag., XV, 1863, p. 22 (pl. XX in vol. XIV, figs. 1, 2).

Anodonta melinia BOURGUIGNAT, Moll. Peu Con., 1863, p. 50, pl. XXVIII; Rev. et Mag., 1865, pl. XXIV, figs. 1-5.

Anodonta elachista BOURGUIGNAT, Moll. Peu Con., 1863, p. 60, pl. XXXI, figs. 12-14.

Anodonta psammita BOURGUIGNAT, Rev. et Mag., XV, 1863, p. 21 (pl. XXI in vol. XIV, figs. 1-4).

Anodonta pictetiana BROT, Etude Coq. Lem., 1867, p. 45, pl. VIII, figs. 1-3.

Anodon simplicidus SOWERBY, Conch. Icon., XVII, 1867, pl. XII, fig. 40.

No description can be made to cover all the endless variations of this protean species. That, which I have given, will include most of the forms, but many specimens differ from it in one or more characters. The species, as I have recognized it, is very little, if any, more variable than our North American *Anodonta grandis* or *Strophitus edentulus*. Doubtless if these

species could have fallen into the hands of the new school of conchologists in any such abundance as has the unfortunate *Anodonta cygnea*, we would have had several genera and many thousands of species erected on their ruins.

I have endeavored to recognize a few of the more striking forms as varieties, and I have referred them to the author originally describing them and to a few well-known references, but I have not been able to work out at all thoroughly the very elaborate synonymy for these variations.

The species in general may be known by its exactly or almost exactly rounded anterior end, by its moderate wing, the often incurved post-dorsal truncation, by usually being feebly biangulate behind and ending in a point or biangulation at some distance above the base, and by its normally compressed beaks, sculptured over a wide area with rather fine, concentric or slightly wavy bars.

ANODONTA CYGNEA Linnæus, typical.

According to Hanley (Shells of Linnæus, p. 144) the *A. cygnea* var. *cellensis* of Rossmassler (Icon., IV, 1830, pl. XIX, fig. 280) is marked for this in the Linnæan cabinet. It is a large, rather elongated shell, slightly biangulate behind, somewhat cut away on the upper posterior part.

The wing behind is not sharply angulated, the posterior termination is about midway up from the base, the surface is sculptured, especially the later growth, with low, irregular, concentric ridges, the color is ashy, often banded with straw, buff, green or brownish and generally rayless.

Length 180, height 80, diam. 50 mm.

Var. *anatina* (Linnæus).

Shell rather small, compressed, narrowed and rounded in front, with a low dorsal wing which is not much angulated at the junction with the posterior slope; posterior termination rather sharp, elevated but little above the base; surface rayless, ashy or yellowish-green, often with darker concentric bands.

Length 80, height 42, diam. 18 mm.

Mytilus anatinus LINNÆUS, Syst. Nat., 10th ed., I, 1758, No. 1168.—DA COSTA, Hist. Nat. Test. Brit., 1778, p. 215, pl. XV, fig. 2.—SCHRÖTER, Flussc., 1779, p. 160, pl. I, figs. 2, 3. —CHEMNITZ, Conch. Cab., VIII, 1785, p. 189, pl. LXXXVI, fig. 763.—DONOVAN, Brit. Shells, IV, 1802, pl. CXIII.—MATON and RACKETT, Tr. Linn. Soc. Lond., VIII, 1807, p. 110, pl. III*a*, figs. 1, 4.—SCHUMACHER, Ess. Nov. Syst., 1817, p. 107, pl. I, fig. 5.—SHEPPARD, Tr. Linn. Soc. Lond., XIII, 1820, p. 85, pl. V, fig. 5.—WOOD, Ind. Test., 1825, p. 58, pl. XII, fig. 33*e*.—HANLEY, Ipsa. Linn. Conch., 1855, p. 487, pl. II, fig. 1.—WOOD, Ind. Test. Rev., 1856, p. 69, pl. XII, fig. 33.

Anodon anatinus TURTON, Conch. Ins. Brit., 1822, p. 240.—SOWERBY, Rec. and Fos. Sh., XVII, 1823, fig.—REEVE, Conch. Syst., I, 1841, p. 121, pl. XCI, figs. 1, 2.

Anodonta anatina DRAPARNAUD, Hist. Moll. Fr., 1806, p. 135, pl. XII, fig. 2.—C. PFEIFFER, Deuts. L. & S. Moll., 1821, Pt. I, p. 112, pl. VI, fig. 2.—BOSC, Hist. Nat. Coq., III, 1824, p. 143, pl. XXIII, fig. 1.—ROSSMASSLER, Icon., V and VI, 1837, p. 57, pl. XXIX, figs. 417-420.—STABILLE, Faun. Sug., 1845, p. 57, pl. II, fig. 67.—MIDDENDORFF, Sib. Reise, II, 1851, p. 283, pl. XXI, fig. 4; XXIX, figs. 5, 6.—DROUET, Nay. Fr., 1852, p. 4, pl. IV, fig. 1.—DUPUY, Hist. Moll. Fr., 1852, p. 610, pl. XIX, fig. 13.—MOQUIN-TANDON, Moll. Terr. et Fl. Fr., II, 1855, p. 558, pl. XLV, figs. 1, 2.—BROT, Etude Nay. Lem., 1867, p. 38, pl. III, fig. 4; V, fig. 2; VI, figs. 1-3; VII, figs. 1-3. —CLESSIN, Conch. Cab. Ano., 1876, p. 83, pl. XIV, figs. 3, 4; XXVI, figs. 1, 2.

Anodon anatina CATLOW and REEVE, Conch. Nom., 1845, p. 66.

Anodonta cygnea var. *anatina* SIMPSON, Syn., 1900, p. 625.

Anodonta complanata ROSSMASSLER, Icon., I, 1835, p. 112, pl. III, fig. 68; IV, p. 24, pl. XX, fig. 283.—KUSTER, Conch. Cab. Ano., 1853, p. 12, pl. III, figs. 2, 3.—DROUET, Nay. Fr., 1854, p. 8, pl. VII, fig. 1.—MOQUIN-TANDON, Moll. Terr. & Fluv. Fr., II, 1855, p. 560, pl. XLV, figs. 3, 4.—CLESSIN, Deuts. Ex. Moll., 1876, p. 446, fig. 292.—KOBELT, Icon., VI, 1879, p. 44, pl. CLXV, figs. 1650-1654.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 288, figs. 14-14*a*.

Anodon complanatus Sowerby, Conch. Icon., XVII, 1877, pl. IX, fig. 21.

According to Hanley (Shells of Linnæus, p. 144), the *Anodonta complanata* in Rossmassler, Icon., Pt. 4, Plate XX, fig. 283, is contained in the box in the Linnæan collection marked *anatina*. This is a rather small, compressed form, slightly angular in front and behind.

Ortmann, (l. c.), considers this a valid species and states that in his opinion, with this exception, all the Anodontas of central Europe should be referred to *cygnea*.

Var. *piscinalis* Nilsson.

Shell smaller and shorter than the type, solider, with a higher, distinctly angled dorsal wing, the post-dorsal outline usually decidedly incurved; umbonal region generally fuller. Surface rather smooth and shining, the umbonal region reddish-brown, the remainder of the shell having wide, faint bands of dark brown and yellow-green alternating, usually somewhat rayed.

Length 110, height 57, diam. 33 mm.

Length 106, height 60, diam. 33 mm.

Anodonta piscinalis Nilsson, Hist. Moll. Svec., 1822, p. 116. —Rossmassler, Icon., IV, 1836, p. 23, pl. XIX, fig. 281, etc. —Gassies, Moll. Agen., 1849, p. 191, pl. IV, fig. 1.—Dupuy, Hist. Moll. Fr., 1852, p. 612, pl. XXI, figs. 17, 18.—Drouet, Nay. France, No. 5, 1852, p. 11, pl. V, fig. 1.—Kuster, Conch. Cab. Ano., 1853, p. 45, pl. III, figs. 4, 5.—Moquin-Tandon, Moll. Fr., II, 1855, p. 561, pl. XLV, figs. 5, 6; XLVI, figs. 1, 1*a*.

Quite distinct from the *A. cellensis* of Rossmassler, being smaller and shorter than that, and often considerably heavier, with an angular dorsal wing, and rather smooth surface. But the above description only applies to typical forms of *piscinalis* and there is every conceivable variation in every direction.

Var. *ponderosa* C. Pfeiffer.

Shell subrhomboid, rather inflated, solid with a full rounded or slightly biangulate posterior ridge; beaks but slightly ele-

vated, but the region below them full; rather dark, olive or ashy-olive with faint darker bands; nacre white, scarcely pearly, much thickened in front.

Length 110, height 61, diam. 47 mm.

Anodonta ponderosa C. Pfeiffer, Deuts. L. and S. Moll., 1825, Pt. 2, p. 31, pl. iv, figs. 1-6.—Rossmassler, Icon., IV, 1836, p. 24, pl. xx, fig. 282.—Dupuy, Hist. Moll. Fr., 1852, p. 604, pl. xviii, fig. 12.—Kuster, Conch. Cab. Ano., 1853, p. 13, pl. iv, fig. 1.—Drouet, Nay. Fr., 1854, p. 2, pl. vi.

Anodonta cygnea var. *ponderosa* Simpson, Syn., 1900, p. 626.

Quite solid and inflated, the nacre in front being thickened much as it is in *A. implicata*. The region below the beaks is decidedly full.

Var. *rostrata* Rossmassler.

Shell very inequilateral with a full, double posterior ridge, which is carried out to the greatly elongated posterior termination. This is raised a little above the base and generally truncate or subtruncate.

Anodonta rostrata Rossmassler, Icon., IV, 1836, p. 25, pl. xx, fig. 284.—Stabille, Faun. Lug., 1845, p. 59, pl. ii, fig. 70.—Drouet, Nay. Fr., 1852, p. 14, pl. v, fig. 2.—Kuster, Conch. Cab. Ano., 1853, p. 14, pl. iv, fig. 2.—Bourguignat, Rev. et Mag., XV, 1863, p. 23, (also XIV, pl. xxi, fig. 5).

Anodon rostratus Sowerby, Conch. Icon., XVII, 1867, pl. ii, fig. 4.

Anodonta cygnea var. *rostrata* Simpson, Syn., 1900, p. 627.

There is an *Anodonta rostrata* Held in Isis, 1836, page 280. I do not know whether it or that of Rossmassler was published first, or whether the two are the same or not.

The number of specific names bestowed on the Anodontas of Europe must run up into the thousands. I have gone over the literature as carefully as possible, and large series of specimens from many localities, and I confess that I am absolutely unable to separate these forms specifically. The variations of form, size, color, solidity, and even texture are sufficient for a large number of species if they were not everywhere connected by intermediate examples. The new school of conchol-

ogists has named every conceivable variation, and in very many cases distorted individuals. Europe is a densely settled region, and it is possible that the waters of the streams and ponds in many places may be so affected by sewage and other offal as to produce many changes in the mollusks living in them.

ANODONTA RETTERI Drouet.

Shell large, subovate or subrhomboid, inflated, solid, irregularly marked with growth striæ; epidermis lamellated at the border, shining, brown-olive, somewhat yellow below; dorsal line slightly curved; dorsal wing low; posterior slope obliquely truncate, the hinder end of the shell widely rounded; anterior end evenly rounded; basal line incurved behind the middle; beaks rather full, finely plicate, reddish; muscle scars large; nacre milky-white.

Length 125, height 70, diam. 50 mm.

Length 145, height 80, diam. 50 mm.

Pond in the palace of the governor of Samarcand, Turkestan.

Anodonta retteri DROUET, J. de Conch., XLVII, 1899, p. 402, fig.—SIMPSON, Syn., 1900, p. 627.

This seems quite close to the var. *piscinalis* of *Anodonta cygnea,* but Drouet remarks that it is in certain places 4 millimeters in thickness.

ANODONTA LUCASI Deshayes.

Shell elongated, shining, subelliptical or subrhomboid, somewhat inflated, of moderate solidity, inequilateral, with rather full, high beaks for a member of the group, their sculpture not observed; posterior ridge full, rounded; dorsal wing somewhat developed and angled in young shells, low and hardly angled in old ones: posterior slope subtruncate above, rounded below, dorsal and ventral outlines nearly parallel; anterior end a little narrowed, rounded; epidermis brownish in old shells, pale yellowish-green with brown concentric bands and feeble rays in young shells; nacre bright, bluish-white.

Length 114, height 62, diam. 37 mm.

Algiers.

Anodonta lucasi DESHAYES, Hist. Nat. Moll. Alg., 1847, pl. CVIII, figs. 1, 2.—BOURGUIGNAT, Mal. Alg., 1864, II, p. 296, pls. XXIII, XXIV, fig. 1.—SOWERBY, Conch. Icon., XVII, 1867, pl. XVII, fig. 64.—SIMPSON, Syn., 1900, p. 627.

Margaron (Anodonta) lucasii LEA, Syn., 1870, p. 78.

Anodonta embia BOURGUIGNAT, Mal. Alg., 1864, II, p. 297, pl. XXV.

Close to *A. cygnea* and probably only a form of it. Deshayes figured it beautifully in the Historie Naturelle d'Algerie, but did not describe it. Sowerby's figure in the Conchologia may represent a young shell. The species, if species it is, seems to differ a little from *A. cygnea* in texture, in the warm color of the epidermis, and brightness of the nacre.

ANODONTA CILICIA Kobelt.

Shell evenly long elliptical, inequilateral, somewhat inflated, with low, concentrically, obsoletely plicated beaks; posterior ridge low, feebly and widely biangulate; surface strongly sulcate, especially at the rest periods, which are plainly indicated; epidermis ashy-brown, slightly rayed near the beaks; nacre bluish-white; anterior muscle scars distinct; posterior scars inconspicuous.

Length 90, height 50, diam. 31 mm.

Cilicia, north of Tarsus.

Anodonta cilicia KOBELT, Icon., 1st Supp., 1895, p. 24, pl. VII*a*, fig. 1.—SIMPSON, Syn., 1900, p. 627.

I have never seen this shell, which in all probability is nothing more than a mere variety of *A. cygnea*. If the description of it is accurate it is rather strongly concentrically sculptured and the figure shows the rest periods quite plainly. The color seems to be a uniform ashy-brown.

ANODONTA NUMIDICA Bourguignat.

"Shell ventricose, slightly oblong, biangulate behind, very thin and fragile; epidermis membranaceous, with regular concentric striæ, grayish-yellow, elegantly radiated with green, especially on the posterior region; nacre bluish-white; anterior

end rounded; posterior end oblong, slightly angulated. Beaks placed anteriorly, not prominent, usually eroded, but, when perfect, with quite strong, transverse ridges. Corselet raised and compressed. Ligament small.

Length 75-85, height 46-50, diam. 30-35 mm." (Bourguignat.)

Type locality, a small lake east of la Calle.

Anodonta lucasi (part) DESHAYES, Hist. Nat. Moll. Alg., 1847, pl. CVIII, fig. 3.

Anodonta numidica BOURGUIGNAT, Mal. Alg., 1864, II, p. 298, pl. XXIV, figs. 2-6—SIMPSON, Syn., 1900, p. 627.

Anodonta letourneauxi BOURGUIGNAT, Mal. Alg., 1864, II, p. 299, pl. XXVI, figs. 2-6.

"The *Anodonta numidica* differs from *A. lucasi*, with which it has been confounded, by its smaller size, more globosely inflated and shorter shell, more membraneous epidermis, which is more regularly striate and with stronger rays; the dorsal margin is straighter, the basal margin convex and not straight; the more anterior beaks; the corselet more elevated, more developed, and more compressed; the smaller ligament, etc."

ANODONTA SUBCIRCULARIS Clessin.

Shell subrhomboid, subinflated, with rather low but widely rounded beaks, their sculpture consisting of a number of curved, nearly parallel bars; dorsal wing somewhat developed, nearly straight on the upper line, its hinder end rounded; posterior slope obliquely truncate; posterior ridge low, widely, feebly double and ending behind in a wide, ill-defined biangulation near the base of the shell, base line nearly straight; anterior end rounded, a little cut away below; surface covered with strong, low, irregular concentric ridges; epidermis yellowish-ashy with a few feeble brown rays; nacre white, somewhat iridescent.

Length 95, height 64, diam. 32 mm.

Scutari Lake, European Turkey.

Anodonta subcircularis CLESSIN, Conch. Cab. Ano., 1873, p. 87, pl. XXII, figs. 3, 4.—SIMPSON, Syn., 1900, p. 628.

The type has been slightly injured near the posterior base and the outline of the shell is here a little drawn in. It is a rather short, rounded rhomboid shell, and seems to be quite strongly sculptured.

ANODONTA VESCOIANA Bourguignat.

Shell irregularly elliptical, much inflated, thin, nearly equilateral, with large, full, rather high beaks; ligament large and elevated; posterior slope somewhat truncated, there being an angle where it joins the dorsal line; posterior ridge low, ending in a blunt point midway up from the base; anterior end and base rounded; epidermis greenish-gray, the rest periods often being plainly exhibited, sometimes faintly rayed; nacre bluish-white, iridescent.

Length 95, height 62, diam. 50 mm.

Length 86, height 56, diam. 45 mm.

Asia Minor.

Anodonta vescoiana BOURGUIGNAT, Ann. Mal., II, 1857, p. 34, pl. 1, figs. 1, 2.—CLESSIN, Conch. Cab. Ano., 1873, p. 100, pl. XXIX, figs. 1, 2.—KOBELT, Icon., VII, 1880, p. 83, pl. CCVII, fig. 2102.—SIMPSON, Syn., 1900, p. 628.

Margaron (Anodonta) vescoiana LEA, Syn., 1870, p. 81.

Anodonta vescoiana var. *mesopotamica* MOUSSON, Jl. de Conch., XXII, 1874, p. 51.—KOBELT, Icon., new ed., XIX, 1912, p. 36, pl. DXXIX, fig. 2732.

? Anodonta schlæflii MOUSSON, Jl. de Conch., XXII, 1847, p. 51.

? Anodonta schlaflii SIMPSON, Syn., 1900, p. 648.

A greatly inflated species with very large, full and high beaks, which are placed only a little in front of the center of the shell.

ANODONTA BERINGIANA Middendorff.

Shell elongated, irregularly ovate, being a little wider in front, decidedly inequilateral, scarcely subsolid, with a low, rounded posterior ridge; beaks low and rather compressed, but the umbonal region below them is full, their sculpture consisting of nearly straight bars, which run almost parallel with

the hinge line; post-dorsal wing scarcely developed; surface with low, irregular, concentric ridges; epidermis olive-green, with lighter bands on young shells, dark green or blackish on old ones; nacre dull bluish or lead-color.

Length 140, height 80, diam. 50 mm.

Length 155, height 75, diam. 52 mm.

Kamchatka; Alaska.

Anodonta cellensis SCHÖTER var. *beringiana* MIDDENDORFF, Sib. Reise, II, 1851, p. 284, pl. XXVIII, figs. 4-7; XXIX, figs. 1-4.—CLESSIN, Conch. Cab. Ano., 1875, p. 211, pl. LXV, figs. 1, 2.

Anodonta youconensis LEA, Pr. Ac. Nat. Sci. Phila., XI, 1867, p. 81.

Anodonta youkanensis LEA, Jl. Ac. Nat. Sci. Phila., VI, 1868, p. 287, pl. XL, fig. 99; Obs., XII, 1869, p. 47, pl. XL, fig. 99. —CLESSIN, Conch. Cab. Ano., 1874, p. 133, pl. XLIII, figs. 1, 2.

Margaron (Anodonta) youkanensis LEA, Syn., 1870, p. 80.

Anodonta youcanensis PETEL., Conch. Sam., III, 1890, p. 186.

Anodonta beringiana SIMPSON, Syn., 1900, p. 628.

Anodonta cygnea beringiana HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 125, pl. V, figs. 5-6.

A large, rather inflated, dark colored, somewhat rough species with dull colored nacre. It seems to be most nearly related to *A. cygnea* but is darker colored within and without; the post-dorsal wing is less developed and the dorsal slope is hardly ever truncated. Dr. Wm. H. Hall collected shells at Petropaulovsk, Kamchatka, that I consider identical with the Alaskan form.

ANODONTA KENNERLYI Lea.

Shell very thin, much elongated, generally elliptical, scarcely inflated, very inequilateral, the low rather flat beaks being placed near the anterior end, their sculpture not seen; posterior ridge low and rounded; dorsal wing but slightly developed, anterior end sometimes a little truncated; surface dull and concentrically striated behind, rather rough; epidermis greenish-

olive or brownish, showing the rest periods quite plainly; nacre bluish-white sometimes a little iridescent behind.

Length 93, height 47, diam. 27 mm.

Length 85, height 42, diam. 27 mm.

Puget Sound; British Columbia.

Type locality, Chiloweyuck Depot, Puget Sound.

Anodonta kennerlyi LEA, Pr. Ac. Nat. Sci. Phila., IV, 1860, p. 306; Jl. Ac. Nat. Sci. Phila., V, 1862, p. 108, pl. XVIII, fig. 256; Obs., VIII, 1862, p. 112, pl. XVIII, fig. 256.—SIMPSON, Syn., 1900, p. 628.

Anodon kennerlyi SOWERBY, Conch. Icon., XVII, 1870, pl. XXXIV, fig. 139.

Margaron (Anodonta) kennerlyi LEA, Syn., 1870, p. 79.

Anodonta cygnea (part) HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 125.

Apparently a rare form, but all the specimens I have seen seem to be distinct from any other species. The shell is exceedingly thin, like the *Anodonta marginata* of Say, and is shaped something like that species, being much elongated. It is not so smooth as Say's species. The epidermis is rather dull and the rest periods are well marked in all the examples I have seen.

ANODONTA OREGONENSIS Lea.

Shell long elliptical, inequilateral, moderately strong, scarcely inflated, with rather low, somewhat corrugated beaks, their sculpture consisting of fine, somewhat corrugated bars running generally parallel with the hinge line; dorsal line nearly straight; dorsal wing slightly developed, angled and obliquely truncate behind; posterior ridge low, faintly double and ending in a feeble biangulation behind about on the median line; surface smooth, pale greenish-yellow or yellowish-green, often banded with darker color and showing the rest periods, shining; nacre bluish-white, sometimes tinged purplish, usually thicker in front.

Length 114, height 57, diam. 35 mm.

Length 94, height 50, diam. 30 mm.

Washington; Oregon; North California; East to Great Salt Lake.

Type locality, Wahlamat River near its junction with the Columbia.

Anodonta oregonensis LEA, Tr. Am. Phil. Soc., VI, 1838. p. 80, pl. XXI, fig. 67; Obs., II, 1838, p. 80, pl. XXI, fig. 67.—CLESSIN, Conch. Cab. Ano., 1874, p. 170, pl. LVI, figs. 5, 6. —SIMPSON, Syn., 1900, p. 628.

Margarita (Anodonta) oregonensis LEA, Syn., 1838, p. 30.

Anodon oregonensis CATLOW and REEVE, Conch. Nom., 1845, p. 67.—SOWERBY, Conch. Icon., XVII, 1867, pl. XVII, fig. 63.

Margaron (Anodonta) oregonensis LEA, Syn., 1852, p. 49; 1870, p. 78.

Anodon cognata GOULD, Proc. Bost. Soc. Nat. Hist., III, 1850, p. 294.

Anodonta cognata GOULD, U. S. Expl. Exp., XII, 1852, p. 435, figs. 546, 546*a*, 546*b*.

Anodonta cygnea (part), HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 125, pl. V, figs. 3, 4, 8.

Lea describes this as a thin shell, but nearly all the specimens in his collection, including most of those of the type lot, which he received from Nuttall, are more or less solid. A fine specimen in his collection from Fort George, Oregon, is as solid in front as many of the Unios. I am not sure that the type shell—the one figured—is in the Lea Collection, though one of the Nuttall shells, which is broken, may be that. In general, this form is reasonably distinct. It is shaped like some of the specimens of *A. implicata* or *A. cataracta*, is generally decidedly greenish in its general tint and shining. It is larger and much less winged or cut away at the dorsal slope than *A. wahlametensis*.

ANODONTA CALIFORNIENSIS Lea.

Shell very thin, irregularly obovate, subcompressed, its greatest inflation being a little in front of the middle; posterior ridge low, rounded; in front of the ridge the shell is decidedly compressed; dorsal wing considerably developed, angulate behind;

post-dorsal slope somewhat truncate; beaks low but sharp, rising above the dorsal line, with a number of rather strong ridges, which nearly follow the growth lines but sometimes are feebly, doubly looped; surface nearly smooth; epidermis shining, greenish or pale olive-green, ashy or pale brownish in the umbonal region, with two or three green rays on the posterior slope; nacre whitish, flesh-colored or lurid purplish, a little thicker in front, soft textured and shining.

Length 75, height 40, diam. 18 mm.

Length 55, height 33, diam. 17 mm.

California; east to Utah and Arizona.

Type locality, Rio Colorado, Cal.

Anodonta californiensis LEA, Tr. Am. Phil. Soc., X, 1852, p. 286, pl. XXV, fig. 47; Obs., V, 1852, p. 42, pl. XXV, fig. 47.—MUSGRAVE, Phot. Conch., 1863, pl. 1, fig. 4.—CLESSIN, Conch. Cab. Ano., 1874, p. 120, pl. XXXIX, figs. 4, 5.—SIMPSON, Syn., 1900, p. 629.

Margaron (Anodonta) californiensis LEA, Syn., 1852, p. 47; 1870, p. 75.

Anodon californiensis SOWERBY, Conch. Icon., XVII, 1870, pl. XXVIII, fig. 113.

Anodonta cygnea impura (part), HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 125.

Typically this shell is reasonably distinct, but there are a good many specimens that seem to stand between it and *A. nuttalliana*. The obovate form, the contraction in front of the low, rounded, posterior ridge, making the outline in front of this decidedly wedge-shaped when viewed from above or below and the delicate glossy texture within and without are characters of importance in this species.

ANODONTA NUTTALLIANA Lea.

Shell typically subrhomboid, a little narrow in front, thin, convex, with a well-developed post-dorsal wing, which meets the truncation of the posterior slope with a decided angle; posterior ridge scarcely developed though the shell is generally full in this region; beaks compressed, low, but beginning

in a sharp prodissoconch, their sculptures consisting of numerous rather fine, corrugated, concentric ridges; surface with irregular growth lines; epidermis yellowish-green, ashy or lead-color, scarcely shining, seldom having feeble rays; nacre bluish-white, rather dull, sometimes a little iridescent behind.

Length 70, height 47, diam. 27 mm.

Washington to California; east to Utah.

Type locality, Wahlamat River near its junction with the Columbia.

Anodonta nuttalliana LEA, Tr. Am. Phil. Soc., VI, 1838, p. 77, pl. XX, fig. 62; Obs., II, 1838, p. 77, pl. XX, fig. 62.—CLESSIN, Conch. Cab. Ano., 1874, p. 147, pl. L, figs. 1, 2.—SIMPSON, Syn., 1900, p. 629.

Margarita (Anodonta) nuttalliana LEA, Syn., 1838, p. 29.

Margaron (Anodonta) nuttalliana LEA, Syn., 1852, p. 47; 1870, p. 75.

Anodon nuttalliana CATLOW and REEVE, Conch. Nom., 1845, p. 67.

Anodonta triangularis TRASK, Pr. Cal. Ac. Nat. Sci., I, 1855, p. 29.

Anodon triangularis SOWERBY, Conch. Icon., XVII, 1870, pl. XXIX, fig. 56*b*.

Anodonta cygnea impura (part), HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 125.

This species, if species it may be called, seems to stand about midway between the rude, dark, dull colored *A. wahlametensis* and the delicate, shining *A. californiensis*. Dr. R. E. C. Stearns believes that all three of these forms run together and there is much ground for such a position, as there is a good deal of material which cannot be satisfactorily assigned to any of the three. The same thing, however, may be said of most of the closely related forms of Anodontas wherever they are found. *A. nuttalliana* is more rhomboid, is stronger and duller colored than *A. californiensis*. It is less robust than *A. wahlametensis*, the wing is not so high, the posterior slope is rarely incurved, the posterior point is not so decided and the color is not as dark.

Var. *idahoensis* Hemphill.

"In general outline this variety is more oval than any of the other forms of our West Coast Anodons. It occupies a position between *A. californiensis* and *A. oregonensis* and is one of those intermediate forms that are constantly occurring and shake our faith in what we call species.

In the proportions of its length and height and its rounded posterior outline, it resembles *Anodonta californiensis*. In its breadth between valves, and the smaller and more pointed anterior end of the shell, and more especially in the less developed dorsal prolongations of the valves, it resembles *A. oregonensis*.

In color and lines of growth it agrees fairly well with both of the other species. In the young state the shell is higher in proportion to its length, while the wings or dorsal prolongation of the valves are a little more produced. The umbones of the very young of all our West Coast forms, until they have attained about a half-inch in length, present a peculiar wavy or corrugated appearance, a constant character, so far as I have observed, and one that seems to have been overlooked by writers upon our Anodons.

Length 2¼, height 1⅝, diam. ⅞ inches." (Hemphill).

Type locality, Spokane River, above Post Falls, Idaho.

Anodonta nuttalliana var. *idahoensis* Hemphill, Zoe, I, 1891, p. 328, pl. x, figs. 3, 4.

Anodonta wahlametensis Lea.

Shell variable in form, irregular obovate, ovate or rhomboid, generally rather strong, scarcely inflated, quite inequilateral; dorsal wing well produced, angular behind; dorsal slope excavately truncated, the truncation ending below in a generally upturned, rounded point at or above the median line; beaks low and compressed but pointed, their sculpture consisting of numerous, somewhat doubly looped ridges; surface irregularly concentrically striate, sometimes ridged; epidermis olive or brownish, often rough but occasionally shining; nacre

bluish-white, occasionally tinted with lurid purple, rather dull, thicker in front.

Length 87, height 62, diam. 27 mm.

Length 87, height 55, diam. 27 mm.

Washington; south to southern California; east to Utah.

Type locality, Wahlamat River near its junction with the Columbia.

Anodonta wahlametensis LEA, Tr. Am. Phil. Soc., VI, 1838, p. 78, pl. XX, fig. 64; Obs., II, 1838, p. 78, pl. XX, fig. 64.—HANLEY, Biv. Shells, 1843, p. 215, pl. XXIV, fig. 13.—CLESSIN, Conch. Cab. Ano., 1874, p. 161, pl. LIII, figs. 7, 8.—SIMPSON, Syn., 1900, p. 629.

Margarita (Anodonta) wahlametensis LEA, Syn., 1838, p. 29.

Anodon wahlametensis CATLOW and REEVE, Conch. Nom., 1845, p. 68.—SOWERBY, Conch. Icon., XVII, 1867, pl. IX, fig. 22.

Margaron (Anodonta) wahlametensis LEA, Syn., 1852, p. 47; 1870, p. 75.

Anodonta rotundovata TRASK, Pr. Cal. Ac. Sci., I, 1855, p. 29.

Anodon rostratus SOWERBY, Conch. Icon., XVII, 1867, pl. II, fig. 4.

Anodonta laosensis FISCHER, Bull. Soc. H. N. Autun., 1891, p. 219.

Anodonta cygnea impura (part), HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 125.

Quite variable in form, but generally having a high wing and an upturned, rounded point or beak behind, above which the truncation of the posterior slope is decidedly incurved. The shell is usually larger and darker than either *A. californiensis* or *nuttalliana*. Certain specimens of this species gape at the anterior base.

Sowerby states that his *A. rostratus* is from Laos, an error without doubt, as it is certainly *A. wahlametensis*. As the name *rostrata* had been used for an *Anodonta* by Kokeil (or Rossmassler) Fischer changed Sowerby's name to *laosensis*.

ANODONTA COARCTATA Anton.

Shell rhomboid or subtrapezoidal, quite inequilateral, convex, thin, with a shining, olive epidermis; surface finely, concentrically striated; beaks low but pointed; post-dorsal region elevated, rounded behind, the posterior slope truncated; base line straight; anterior end rounded or subtruncate above; nacre bluish-white.

Length 51, height 34, diam. 18 mm.

Lake Chapala, State of Jalisco, Mexico.

Anodonta coarctata ANTON, Verz. der Conch., 1839, p. 16.—KUSTER, Conch. Cab. Ano., 1853, p. 34, pl. VIII, fig. 2.—SIMPSON, Syn., 1900, p. 630.—VON MARTENS, Biol. Cent. Amer., Moll., 1900, p. 525, pl. XL, figs. 1-7.—DALL, Pr. U. S. Nat. Mus., XXXV, 1908, p. 180, pl. XXIX, figs. 3, 4.

Andonta chapalensis CROSSE and FISCHER, J. de Conch., XL, 1892, p. 295.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 518, pl. LXIV, figs. 8-11.

Anodonta cygnea impura (part), HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 125.

Anton very briefly described his species, but did not figure it. Kuster gives a figure in the Conchylien Cabinet. The specimens figured as *A. chapalensis* in the Mission Scientifique so closely agree with Kuster's figure of *coarctata* that I cannot believe that they are distinct. The shell is subrhomboid or subtrapezoid instead of being obovate like *A. exilior*.

ANODONTA EXILIOR Lea.

Shell is rather small or medium size, somewhat obovate, inequilateral, rather full, with a moderate post-dorsal wing, behind which it is only subtruncate; posterior ridge scarcely developed, rounded; beaks low, compressed, their sculpture consisting of faint, straight or slightly corrugated ridges; surface smooth; epidermis greenish-olive sometimes brownish, occasionally banded and clouded with dark green, shining; nacre

bluish-white to sky blue, iridescent behind, often slightly thickened in front.

Length 52, height 32, diam. 17 mm.

Length 55, height 35, diam. 18 mm.

Length 43, height 30, diam. 15 mm.

Mexico, mostly in the Pacific drainage.

Anodonta exilior LEA, Pr. Ac. N. Sci. Phila., I, 1871, p. 188; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 24, pl. VII, fig. 21; Obs., XIII, p. 28, pl. VII, fig. 21.—SIMPSON, Syn., 1900, p. 630.—VON MARTENS, Biol. Cent., Amer., Moll., 1900, p. 530, pl. XL, figs. 8-11.

Anodonta chalcoensis CROSSE and FISCHER, J. de Conch., XLI, 1893, p. 110.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 522, pl. LXIV, figs. 7, 7*a*.

Anodonta cygnea impura (part), HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 125.

A rather small, smooth, attractive species, which is found in the Pacific drainage of Mexico, though it is probable that it has been found in streams draining into the Gulf of Mexico. Dr. William Palmer reports that it is cultivated in artificial tanks in Durango and used for preparing soup, which he claims is of fine quality. Fischer and Crosse believed that their *A. chalcoensis* differed from *A. exilior*, basing their opinion chiefly on the fact that it was more elongated than Lea's shell. I have seen a large number of specimens from several localities and there is every degree of form from almost orbicular to rather long obovate.

ANODONTA RICHARDSONI von Martens.

Shell subtriangular or subrhomboid, rather inflated, inequilateral, with a low, sometimes scarcely developed, dorsal wing; posterior slope truncated; beaks low, their sculpture concentric, undulated bars; posterior ridge low, somewhat double, ending near the base in a wide biangulation; surface with close, concentric striæ and frequent broader ridges; epidermis

gray and without luster; nacre bluish, sometimes reddish in the center.

Length 59, height 41, diam. 23 mm.

Length 41, height 28, diam. 15.5 mm.

Length 36.5, height 25, diam. 12 mm.

Northwest Mexico; Rio Ameca, State of Jalisco.

Anodonta richardsoni VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 529, pl. XLI, figs. 1, 1*a*, 2, 2*a*.

Seems to be rather closely related to *A. exilior* and *A. coarctata*, but it has concentric wider and narrower ridges and the epidermis is lusterless.

ANODONTA IMPURA Say.

"Subovate, fragile, a little compressed, dull yellowish-brown; umbo much eroded, exhibiting a chalky white stratum, then a dull wax-yellow surface; beak a little undulated, hardly elevated above the general curvature; hinge margin forming a large angle with the base, being anteriorly elevated into an obtuse angle, whence the edge descends almost rectilinearly to the anterior margin, which is equally rounded with the posterior margin.

Length one inch and three-tenths, breadth less than two inches. Convexity less than seven-tenths. Inhabits Mexico." (Say).

Anodonta impura SAY, N. H. Diss., II, 1829, p. 355.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 536.—VON MARTENS, Biol. Cent. Am., Moll., 1900, p. 530.—SIMPSON, Syn., 1900, p. 635.

? Anodonta cygnea impura HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 125, pl. V, figs. 1, 2, 7.

The types of this species have been lost and the form has never been definitely determined. In the Synopsis, I stated that "it is quite likely that it is the same as *A. henryana*."

Fischer and Crosse, (l. c.), say, "from the dimensions and diagnosis, we believe that this species is related to *A. coarctata* Anton and *A. exilior* Lea."

Von Martens, (l. c.), considers it to be probably the same as *A. chalcoensis* Crosse and Fischer.

Hannibal, (l. c.), considers it a variety of *cygnea* and refers to it as synonyms, *A. nuttalliana* Lea, *wahlametensis* Lea, *coarctata* Anton, *californiensis* Lea, *chapalensis* Crosse and Fischer, *exilior* Lea, and *chalcoensis* Crosse and Fischer. His figures cited above are from Californian specimens and he does not appear to have had any Mexican specimens for comparison.

Group of *Anodonta dejecta.*

Shell rather solid, subtrapezoidal, narrower and rounded in front, where it is often considerably thickened, with a slight post-dorsal wing; beaks compressed, the sculpture consisting of numerous irregular ridges, which have a tendency to become doubly looped and nodulous; epidermis smoothish and shining, greenish or ashy-brown; nacre lurid, darker in the cavity of the beaks; muscle scars irregular, not well defined; dorsal scars few and rather deep.

Animal having the branchiæ dark colored, the inner wider in front, nearly or quite free from the abdominal sac, the outer wrinkled on the outside into longitudinal and vertical folds, all four united to the mantle to the extreme posterior end; palpi very large; mantle with a wide, thickened double edge; branchial opening with numerous papillæ; anal opening smooth; superanal opening long, deep, united a long way below.

ANODONTA DEJECTA Lewis.

Shell long, rhomboid or trapezoid, subinflated, strong, with a well-developed, rounded posterior ridge, inequilateral; beaks low, widely spread in the adult but rather flat, their sculpture consisting of irregular, concentric, corrugated folds, often extending well over the umbonal region; greatest diameter of the shell at or behind the middle; in front of the posterior ridge there is often a wide, shallow, radial depression, and viewed from above the front end of the shell is wedge-shaped; anterior end narrowed, sometimes drawn out a little but al-

ways rounded; dorsal wing low, subangular behind; posterior slope truncate; surface with irregular growth lines, which sometimes form ridges; epidermis pale olive-green or dirty brownish, sometimes banded and faintly rayed, somewhat shining; nacre dull whitish or bluish, usually lurid purple in the cavity; hinge sometimes thickened and showing faint vestiges of teeth.

Length 85, height 48, diam. 27 mm.

Length 84, height 44, diam. 27 mm.

Arizona?; southeastern California; northwest Mexico.

Anodonta dejecta LEWIS, Field and Forest, I (August and September), 1875, p. 26; Yarrow's Report, 1875, p. 952.—SIMPSON, Pr. U. S. Nat. Mus., XIX, 1896, p. 372, pl. XXXII, figs. 4, 5; Syn., 1900, p. 630.

Anodonta mearnsiana SIMPSON, Nautilus, VI, 1893, p. 134.

Arnoldina dejecta HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 129, pl. VI, fig. 9.

This species approaches *A. californiensis* on the one hand and forms of *Gonidea angulata* on the other. It is generally larger and always heavier than the former as well as more rhomboid and brilliant. It never has the sharp posterior ridge of the latter, nor its incipient teeth. I have examined many specimens of the animal but have never seen one gravid.

It is said to be from Arkansas River or its tributaries west of the one hundredth meridian and collected by Dr. H. C. Yarrow, surgeon and naturalist of Wheeler's expedition. This locality is erroneous, as it belongs, no doubt, exclusively to the Pacific drainage.

Hannibal, (l. c. p. 128), makes this species the type of a new genus, *Arnoldina*, based on "the development, peculiar beak sculpture and an indescribable velvety texture of the shell."

Group of *Anodonta cataracta*.

Shell thin or solid, inflated, rather evenly rounded in front, generally somewhat biangulate behind and very slightly winged in the post-dorsal region; beaks rather full, the sculpture consisting of a moderate number of concentric ridges or corruga-

tions, which are generally somewhat doubly looped and often slightly nodulous; epidermis bright and shining, sometimes faintly rayed.

Animal having the branchiæ large, inner larger in front, free in part from the abdominal sac; marsupium occupying the entire outer gills, forming an enormously thick, liver-colored pad when filled; mantle thin, thickened on its edge; branchial papillæ small; anal opening smooth.

ANODONTA CATARACTA Say.

Shell ovate, long elliptical or rarely somewhat obovate, inflated, generally thin, inequilateral, with a low post-dorsal wing, scarcely truncate behind it; beaks usually full and raised above the dorsal outline, their sculpture consisting of several corrugated ridges that have a tendency toward being doubly looped; posterior ridge moderately developed, generally feebly biangulate; surface with irregular growth lines, which are often developed into concentric ridges around the border of the shell; epidermis generally shining, greenish-yellow, yellow-green or olive, usually banded with darker color and often faintly rayed; nacre bluish-white, not shining, very rarely thickened in front.

Length 135, height 70, diam. 50 mm.

Lower St. Lawrence drainage; streams draining into the Atlantic south to North Carolina. This species has been cited from Grand River, Michigan, and from north of Lake Superior. Mr. Bryant Walker states that the former locality is erroneous, and I presume that the latter is.

Type locality not given.

Anodonta cataracta SAY, Nich. Enc., 1st ed., II, 1817, pl. III, fig. 4.—DESHAYES, Tr. Elem., I, 1853, Pt. 2, p. 218, pl. XXX, fig. 4.—KUSTER, Conch. Cab. Ano., 1853, p. 33, pl. VII, fig. 2. —SIMPSON, Syn., 1900, p. 631.

Unio cataracta DESHAYES, Tr. Elem. Conch., 1839, p. 18, pl. XXX, fig. 1.

Anodon cataracta CATLOW and REEVE, Conch. Nom., 1845, p. 66.

Mytilus cataractus EATON, Zool. Text-book, 1826, p. 224.

Anodon cataractus SOWERBY, Conch. Man., 1839, fig. 152; Conch. Icon., XVII, 1867, pl. IX, fig. 25.

? Mytilus fluviatilis DILLWYN, Cat., I, 1817, p. 316.

Anodonta fluviatilis BOSC, Hist. Nat. Coq., 1824, III, p. 143.

Margarita (Anodonta) fluviatilis LEA, Syn., 1836, p. 51; 1838, p. 30.

Anodon fluviatilis GOULD, Inv. Mass., 1841, p. 117, fig. 80.—DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 203, pl. XVIII, fig. 234.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 94, fig. 192.—SOWERBY, Conch. Icon., XVII, 1869, pl. XXII, fig. 86.—BINNEY, Inv. of Mass., 2d ed., 1870, p. 178, fig. 480.

Margaron (Anodonta) fluviatilis LEA, Syn., 1852, p. 50; 1870, p. 80.

Mytilus marginatus EATON, Zool. Text-Book, 1826, p. 224.

Anodonta dignota FERUSSAC, Guer. Mag., 1835, p. 25.

Anodonta virgulata LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 86; Jl. Ac. N. Sci. Phila., V, 1862, p. 213, pl. XXXIII, fig. 282; Obs., IX, 1863, p. 35, pl. XXXIII, fig. 282.—CLESSIN, Conch. Cab. Ano., 1874, p. 152, pl. XLIX, figs. 1, 2.

Margaron (Anodonta) virgulata LEA, Syn., 1870, p. 80.

Anodonta williamsii LEA, Pr. Ac. N. Sci. Phila., VI, 1862, p. 169; Jl. Ac. N. Sci. Phila., VI, 1866, p. 27, pl. X, fig. 26; Obs., XI, 1867, p. 31, pl. X, fig. 26.—CLESSIN, Conch. Cab. Ano., 1874, p. 154, pl. LI, figs. 1, 2.—SOWERBY, Conch. Icon., XVII, 1870, pl. XXVIII, fig. 112.

Margaron (Anodonta) williamsii LEA, Syn., 1870, p. 81.

Anodonta tryonii LEA, Pr. Ac. N. Sci. Phila., VI, 1862, p. 169; Jl. Ac. N. Sci. Phila., VI, 1866, p. 28, pl. X, fig. 27; Obs., XI, 1867, p. 32, pl. X, fig. 27.—CLESSIN, Conch. Cab. Ano., 1874, p. 155, pl. LI, figs. 3, 4.

Margaron (Anodonta) tryonii LEA, Syn., 1870, p. 80.

Anodon tryonii HARTMAN and MICHENER, Conch. Cest., 1874, p. 95, fig. 195.

This species is probably better known by Dillwyn's name, *fluviatilis*. According to Binney, (Bib. Am. Con., II, p. 277), the first edition of Nicholson's Encyclopedia appeared in 1817. Dillwyn refers his species to Gmelin, who states that his shell

came from the fresh waters of Europe, and is allied to *anatina*, and it is quite likely it is *A. cygnea*. As there can be no doubt about Say's species, I think it best to use his name.

It is an abundant, widely distributed and variable species. As a rule the shell is smoother, thinner and less distinctly bi-angulate behind than the nearly related *A. implicata*. The latter, when adult, usually becomes quite solid anteriorly, though not always, and the nacre turns to flesh-color, pale lurid purple or dull salmon. But there are many specimens, which can scarcely be said to be either one or the other. *A. virgulata* is a southern form of this species, which is perhaps a little brighter colored than the majority of northern specimens, but it hardly seems to be worthy of varietal rank. *A. williamsii* and *A. tryonii* are also slight variations, but I do not think them any more worthy of specific or varietal rank than several other manifestations of this species.

ANODONTA MARGINATA Say.

Shell long elliptical or long ovate, subinflated, inequilateral, thin; beaks raised a little above the dorsal line, subcompressed to moderately full, their sculpture consisting of a number of irregular, fine, somewhat doubly looped, often wavy bars; posterior ridge low, rounded or faintly double, ending behind about midway up from the base in a rounded or slightly bi-angulate point; surface with irregular growth lines, which sometimes become concentric ridges; epidermis ashy-olive-greenish or brownish, often with narrow, darker bands, especially at the rest periods, rarely faintly rayed; nacre bluish-white with a peculiar dull, silvery tint, often yellowish or salmon in the cavities, somewhat iridescent behind.

Length 132, height 65, diam. 43 mm.
Length 120, height 55, diam. 45 mm.
Length 85, height 40, diam. 30 mm.
St. Lawrence River drainage.
Type locality not given.

Anodonta marginata SAY, Nich. Encyc., II, 1817, pl. III, fig. 5.
Anodonta marginatus HANLEY, Biv. Shells, 1843, p. 217.

Anodonta fragilis LAMARCK, An. sans. Vert., VI, 1819, p. 85. —DELESSERT, Rec. Coq. Lam., 1841, pl. XIII, figs. *2*, *2a*, *2b*. —CLESSIN, Conch. Cab. Ano., 1873, p. 73, pl. XVII, figs. 3, 4. —CHENU, Ill. Conch., 1858, pl. III, figs. 4, *4a*.—SIMPSON, Syn., 1900, p. 632.

Margarita (Anodonta) fragilis LEA, Syn., 1836, p. 50; 1838, p. 30.

Anodon fragilis CATLOW and REEVE, Conch. Nom., 1845, p. 67.—SOWERBY, Conch. Icon., XVII, 1867, pl. XVII, fig. 61.

Margaron (Anodonta) fragilis LEA, Syn., 1852, p. 49; 1870, p. 78.

Anodonta lacustris LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 84; Jl. Ac. N. Sci. Phila., 1860, p. 363, pl. LXII, fig. 188; Obs., VIII, 1860, p. 45, pl. LXII, fig. 188.—CLESSIN, Conch. Cab. Ano., 1873, p. 110, pl. XXXIII, figs. 5, 6.

Anodon lacustris SOWERBY, Conch. Icon., XVII, 1867, pl. XIX, fig. 73.

Margaron (Anodonta) lacustris, LEA, Syn., 1870, p. 80.

Anodon flava ANTHONY, Am. Jl. Conch., I, 1865, p. 160, pl. XIV, fig. 3.

Anodonta flava B. H. WRIGHT, Check List, 1888.

Anodon pallida ANTHONY, Am. Jl. Conch., I, 1865, p. 162, pl. XV, fig. 3.

Anodonta pallida B. H. WRIGHT, Check List, 1888.

Anodon pallidus SOWERBY, Conch. Icon., XVII, 1867, pl. XI, fig. 29.

Anodon glandulosa ANTHONY, Am. Jl. Conch., I, 1865, p. 163, pl. XVI, fig. 3.

Anodonta glandulosa B. H. WRIGHT, Check List, 1888.

Anodon irisans ANTHONY, Am. Jl. Conch., I, 1865, p. 163, pl. XVI, fig. 2.

Anodonta irisans B. H. WRIGHT, Check List, 1888.

? Anodon hordeum SOWERBY, Conch. Icon., XVII, 1867, pl. XVII, fig. 66.

Anodonta subcarinata CURRIER, Am. Jl. Conch., III, 1867, p. 113, pl. VI, fig. 5.

? Anodon subcylindracea SOWERBY, Conch. Icon, XVII, 1867, pl. XV, fig. 47*a*.

Anodon exilis SOWERBY, Conch. Icon., XVII, 1869, pl. XXII, fig. 84.

? Anodon pholadiformis SOWERBY, Conch. Icon., XVII, 1870, pl. XXVII, fig. 106.

This is almost invariably a thin shell, yet I have seen a few specimens slightly thickened in front. Ordinarily even in old shells the external sculpture shows quite distinctly on the inside. The nacre of this species is different usually from that of any other North American form, having a tint a little like dull silver. The larger dimensions given are for unusually well-developed specimens, the ordinary manifestation being about 85 to 90 millimeters in length.

I am very sure that this = the *A. fragilis* Lamarck, and not the *fluviatilis* Dillwyn, as Dr. Lea believes. Say describes it as very thin and fragile; epidermis green-olive, paler on the disk and greener before (behind), within bluish-white, edged with whitish, and from his dimensions and figure it is a smaller shell than Dillwyn's, the whole agreeing better with the *fragilis* of Lamarck.

ANODONTA TERES Conrad.

Shell somewhat elongated, subrhomboid, wider behind, inflated, inequilateral, with a low post-dorsal wing, which is rounded behind; posterior ridge moderate, double, ending behind in a wide biangulation a little below the median line; the dorsal slope obliquely truncated; beaks moderately full, raised somewhat above the dorsal line, their sculpture not known; epidermis ashy, tinted yellowish.

Conrad states that the shell attains a length of four or more inches. His figure is 75 millimeters long and 38 in height.

Type locality, Santee Canal, South Carolina.

Anodonta teres CONRAD, New F. W. Shells, 1834, p. 47, pl. VII, fig. 2.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 25, pl. II, fig. 9.—SIMPSON, Syn., 1900, p. 633.

I know nothing whatever of this shell beyond the figure and meagre description given by its author. He gives no account of the color of the nacre or epidermis, but the figure shows the latter to be yellowish-ashy. It seems to differ from anything I know, but may possibly be a young *A. hallenbeckii*.

ANODONTA IMPLICATA Say.

Shell oblong, elliptical, often solid, subrhomboid or ovate in outline, subinflated, inequilateral with moderately full beaks, which rise a little above the dorsal outline, their sculpture consisting of straight bars running parallel with the hinge line, or they may be slightly curved and sometimes a little corrugated; posterior ridge well developed, generally more or less double, and ending in a biangulation a little below the median line; surface with irregular growth lines, which sometimes rise into ridges; epidermis yellowish-green, olive or brown, occasionally faintly rayed, scarcely shining, often rough; nacre whitish, dull salmon or purplish, almost always darker in the cavity of the shell, and thickened in front.

Length 125, height 67, diam. 45 mm.

Length 142, height 83, diam. 50 mm.

St. Lawrence drainage; north to Lake Winnipeg; south in streams flowing into the Atlantic to Virginia; not reported from Michigan.

Type locality, Danvers, Mass.

Anodonta implicata SAY, New Harm. Diss., II, No. 22, 1829, p. 340.—CLESSIN, Conch. Cab. Ano., 1873, p. 78, pl. XIX, fig. 3.—SIMPSON, Syn., 1900, p. 633.

Anodon implicata GOULD, Inv. Mass., 1841, p. 118, fig. 78; 2d ed., 1870, p. 180, fig. 481.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 94, fig. 193.

Margaron (Anodonta) implicata LEA, Syn., 1852, p. 50; 1870, p. 80.

? Anodon implicatus SOWERBY, Conch. Icon., XVII, 1867, pl. XIII, fig. 44.

Anodonta newtonensis LEA, Tr. Am. Phil. Soc., VI, 1838, p. 79, pl. XXI, fig. 66; Obs., II, 1838, p. 79, pl. XXI, fig. 66.

Margarita (Anodonta) newtonensis LEA, Syn., 1838, p. 30.

Anodon newtonensis Sowerby, Conch. Icon., XVII, 1867, pl. XVII, fig. 62.

Anodonta newtoniensis Troschel, Arch. für. Naturg., V, 1839, p. 239.

Anodon newtoniana Catlow and Reeve, Conch. Nom., 1845, p. 67.

? Anodon excurvata De Kay, Zool. of N. Y., Moll., Pt. 5, 1843, p. 202, pl. XVII, fig. 233.

Anodonta housatonica Linsley, Am. Jl. Sci., 1845, p. 277.

This is as variable a shell as *A. cataracta*. It is usually more solid than that species, though thin specimens occur, the nacre is almost always thickened, often greatly so, in front, and in nearly all cases it is darker in the cavities. These characters, the rougher epidermis, the higher, more biangular posterior ridge and the biangulation where it ends behind are moderately constant and usually serve to distinguish it from that species.

Anodonta hallenbeckii Lea.

Shell oblong, subelliptical or subrhomboid, inflated, strong, inequilateral, with full beaks, which are elevated above the hinge line, their sculpture not seen; posterior ridge full, rounded, ending in a blunt or rounded point at or below the median line; surface more or less irregularly, concentrically ridged, in some specimens decidedly so; epidermis yellowish or tawny, usually with green bands, often feebly rayed, especially on the posterior slope, sometimes the green color predominates; muscle scars large, irregular; nacre whitish, sometimes lurid in the cavities.

Length 186, height over all 93, diam. 72 mm.

Length 97, height 55, diam. 37 mm.

Georgia.

Type locality, Uhaupee Creek, Macon Co., Ga.

Anodonta hallenbeckii Lea, Pr. Ac. N. Sci. Phila., II, 1858, p. 139; Jl. Ac. N. Sci. Phila., IV, 1859, p. 232, pl. XXXII, fig. 112; Obs., VII, 1859, p. 50, pl. XXXII, fig. 112.—Clessin, Conch. Cab. Ano., 1873, p. 95, pl. XXVIII, figs. 3, 4.—Sowerby, Conch. Icon., XVII, 1869, pl. XXIII, fig. 89.—Simpson, Syn., 1900, p. 634.

Margaron (Anodonta) hallenbeckii LEA, Syn., 1870, p. 78.

Anodonta gesnerii LEA, Pr. Ac. N. Sci. Phila., X, 1858, p. 139: Jl. Ac. N. Sci. Phila., IV, 1859, p. 231, pl. XXXI, fig. 109.—Obs., VII, 1859, p. 49, pl. XXXI, fig. 109.—CLESSIN, Conch. Cab. Ano., 1873, p. 95, pl. XXVIII, figs. 1, 2.

Anodon gesnerii SOWERBY, Conch. Icon., XVII, 1867, pl. VII, fig. 15.

Margaron (Anodonta) gesnerii LEA, Syn., 1870, p. 78.

Anodonta gessneri PÆTEL, Conch. Sam., III, 1890, p. 179.

A magnificent shell, when fully developed, but it is often apparently stunted and, when it is, it becomes somewhat rhomboid and occasionally constricted at the middle of the base line. It was a stunted shell, which has evidently been injured along the middle of the base when it was quite young, that Lea took for his type of *A. hallenbeckii*. Afterwards he named a fine young specimen *A. gesnerii*.

ANODONTA DOLIARIS Lea.

Shell decidedly rhomboid, a little narrowed in front, inflated, strong, somewhat inequilateral, with very full, high beaks, their sculpture not known; posterior ridge high and angled; dorsal wing moderate; posterior slope truncated, the truncation ending in a faint biangulation behind near the base; anterior end rounded, but somewhat cut away below; epidermis smooth and shining, yellowish-green, rayed; cavity of the beaks deep and wide; nacre pale flesh-color, iridescent.

Length 120, height 72, diam. 56 mm.

Type locality, Stewart's Mill Dam, Union County, North Carolina.

Anodonta dolearis LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 193.

Anodonta doliaris LEA, Jl. Ac. N. Sci. Phila., VI, 1866, p. 24, pl. VIII, fig. 23; Obs., XI, 1867, p. 28, pl. VIII, fig. 23.—CLESSIN, Conch. Cab. Ano., 1874, p. 130, pl. XLII, figs. 1, 2.—SIMPSON, Syn., 1900, p. 634.

Margaron (Anodonta) doliaris LEA, Syn., 1870, p. 81.

The type of this fine species was in the cabinet of the late Mr. C. M. Wheatley and I have never seen a specimen which I could refer to it. It is decidedly rhomboid, the posterior slope being obliquely truncated from the dorsal wing nearly to the base, and the anterior end is somewhat cut away below.

ANODONTA DARIENSIS Lea.

Shell excessively variable, irregularly obovate, moderately to greatly inflated, inequilateral, with high, very full beaks, the umbonal swelling extending obliquely out as a posterior ridge as well as in front of the ridge; beak sculpture a few ridges either running nearly parallel with the hinge line or somewhat irregularly doubly looped; post-dorsal wing generally well developed; posterior slope usually truncated obliquely; hinder end of the shell biangulate and on the median line; base somewhat angularly produced about one third of the way from the posterior end; epidermis usually bright greenish or olive-tinted, sometimes banded and having dark rays on the posterior slope; rarely there are a few faint rays on the disk; outer part of the shell often sulcate; nacre bluish or whitish, tinted purple.

Length 108, height 58, diam. 47 mm.

Length 147, height 82, diam. 70 mm.

Length 105, height 54, diam. 42 mm.

Length 97, height 61, diam. 54 mm.

Georgia; North Florida.

Type locality, Hopeton; Swift Creek, Macon; Flint River, Georgia.

Anodonta dariensis LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 139; Jl. Ac. N. Sci. Phila., IV, 1859, p. 230, pl. XXVIII, fig. 99; Obs., VII, 1859, p. 48, pl. XXVIII, fig. 99.—CLESSIN, Conch. Cab. Ano., 1874, p. 118, pl. XXXVII, figs. 3, 4.—SIMPSON, Syn., 1900, p. 634.

Anodon dariensis SOWERBY, Conch. Icon., XVII, 1867, pl. XVIII, fig. 70.

Margaron (Anodonta) dariensis LEA, Syn., 1870, p. 80.

There seems to be almost no limit to the variation of this species. It may be smooth or rough, shining or dull, light or dark, and it varies greatly in the degree of its inflation and elongation. Its most constant distinguishing character is the very full, rounded ridge or inflation that starts with the beaks and is carried outward, then downward and backward towards the posterior termination of the shell. The greatest degree of inflation of this is in front of the posterior ridge.

Group of *Anodonta imbecillis*.

Shell thin, elliptical, sometimes slightly produced near the center of the base, pointed behind, with a slight posterior dorsal wing; area of the beaks generally flattened, though often full; beak sculpture consisting of several rather delicate, irregular ridges, which show a tendency to break into nodules; epidermis bright and smooth, often marked with beautiful, delicate, capillary rays; nacre bluish. Animal sometimes highly colored; gills nearly alike in size, having a distinct border of different texture; eye-spots on branchial opening generally perceptible.

ANODONTA IMBECILLIS Say.

Shell oblong, thin, with dorsal and ventral lines nearly parallel, pointed behind at or above the median line, inequilateral, convex or inflated; beaks compressed or flattened, not projecting above the nearly or quite straight dorsal line, their sculpture consisting of a few rather feeble, irregular, broken ridges, which are sometimes faintly doubly looped; posterior ridge low, curved down in the middle; epidermis generally smooth, yellowish-green or blue-green, often banded and feebly rayed, with two or more wide, ill-defined, dark rays, on the posterior slope; muscle scars scarcely visible; nacre pale blue or bluish-white.

Length 92, height 45, diam. 35 mm.

Length 75, height 38, diam. 25 mm.

Entire Mississippi drainage area; south Michigan; North Carolina to Georgia; southwest to Matamoras, Mexico.

Type locality, Wabash River.

Anodonta imbecillis SAY, N. Harm. Diss., II, No. 23, 1829, p. 355.—CLESSIN, Conch. Cab. Ano., 1874, p. 70, pl. XIX, figs. 4, 5; XXV, fig. 4.—BAKER, Moll. Chicago, Pt. 1, 1898, p. 55, pl. V, fig. 1.—SIMPSON, Syn., 1900, p. 635.

Margaron (Anodonta) imbecillis LEA, Syn., 1852, p. 50; 1870 p. 80.

Anodon imbecillis SOWERBY, Conch. Icon., XVII, 1870, pl XXVII, fig. 102.

Anodonta incerta LEA, Tr. Am. Phil. Soc., V, 1834, p. 46, pl. VI, fig. 16; Obs., I, 1834, p. 158, pl. VI, fig. 16.

Margarita (Anodonta) incerta LEA, Syn., 1836, p. 51; 1838, p. 30.

Anodon incerta CATLOW and REEVE, Conch. Nom., 1845, p. 67.

Anodon incertus SOWERBY, Conch. Icon., XVII, 1867, pl. XVII, fig. 59.

Anodon horda GOULD, Pr. Bost. Soc. N. H., V, 1855, p. 229.

Anodonta hordeum PÆTEL, Conch. Sam., III, 1890, p. 180.

When perfect this is a beautiful, shining species, often of a remarkably blue-green tint. In young or nearly adult shells the beaks are compressed; in old specimens they are often full but flattened. In almost all specimens there is a decided gap at the post-dorsal border and the dorsal slope.

ANODONTA HENRYANA Lea.

Shell oblong, nearly evenly elliptical, subinflated, thin, inequilateral, with compressed beaks, which have feeble, undulated sculpture; dorsal and ventral lines parallel; anterior end rounded; posterior end with a blunt point at or below the median line; surface rather smooth; epidermis pale ashy or yellow-green with two or three dark, wide, feeble rays on the gaping posterior slope; sometimes slightly banded; nacre bluish-white, sometimes with a purplish tint.

Length 72, height 40, diam. 25 mm.

Northeast Mexico; southern Texas.

Type locality, Matamoras and Tamaulipas, Mexico.

Anodonta henryiana LEA, Pr. Ac. N. Sci. Phila., I, 1857, p. 102.

Anodonta henryana LEA, Jl. Ac. N. Sci. Phila., IV, 1860, p. 373, pl. LXVI, fig. 198; Obs., VIII, 1860, p. 55, pl. LXVI, fig. 198.—CLESSIN, Conch. Cab. Ano., 1874, p. 141, pl. XLV, figs. 5, 6.—SIMPSON, Syn., 1900, p. 635.

Margaron (Anodonta) henryana LEA, Syn., 1870, p. 81.

Anodon henryana SOWERBY, Conch. Icon., XVII, 1870, pl. XXXIV, fig. 140.$_2$

Very close to *A. imbecillis* and probably only a southwestern variety of it, as there are intermediate specimens, which are very hard to place. It is normally a little higher in proportion than that species, the posterior point is more blunt, and perhaps a little lower, and the young shells are paler and rougher.

ANODONTA GIBBOSA Say.

Shell thin to strong, ovate or elliptical, inflated, ending behind in a blunt point about at the median line; beaks low and compressed in the young shells, fuller and higher in adult specimens, their sculpture several irregular, feeble, somewhat doubly-looped ridges; surface usually smooth above, but having strong growth lines on the border; epidermis ashy, yellowish-ashy or greenish-ash, with delicate, often wavy rays; two or three of these on the posterior slope are wide and dark; beak cavities capacious in old shells; nacre bluish or greenish in young shells, often becoming purplish in the adult state.

Length 95, height 53, diam. 42 mm.

South Carolina to Florida.

Type locality, South Carolina.

Anodonta gibbosa SAY, Exp. to St. Peters R., 1824, p. 265, pl. XIV, figs. 3, 4.—CLESSIN, Conch. Cab. Ano., 1873, p. 74, pl. XVIII, fig. 3.—SIMPSON, Syn., 1900, p. 635.

Margarita (Anodonta) gibbosa LEA, Syn., 1838, p. 31.

Anodon gibbosa CATLOW and REEVE, Conch. Nom., 1845, p. 67.

Margaron (Anodonta) gibbosa LEA, Syn., 1852, p. 51; 1870, p. 81.

Anodon gibbosus SOWERBY, Conch. Icon., XVII, 1867, pl. IX, fig. 23.

Var. *dunlapiana* Lea.

Shell longer than the typical form, with full, somewhat elevated beaks; becoming large and quite strong.

Length of type 84, height 46, diam. 35 mm.

Length of a large shell 145, height 84, diam. 67, elevation of beaks above dorsal line 6 mm.

Type locality, South Carolina.

Anodonta dunlapiana LEA, Pr. Am. Phil. Soc., II, 1842, p. 225; Tr. Am. Phil. Soc., VIII, 1842, p. 248, pl. XXVII, fig. 65; Obs., III, 1842, p. 86, pl. XXVII, fig. 65.—SOWERBY, Conch. Icon., XVII, 1869, pl. XXIII, fig. 87.—CLESSIN, Conch. Cab. Ano., 1876, p. 220, pl. LXXIV, figs. 1, 2.

Anodonta gibbosa var. *dunlapiana* SIMPSON, Syn., 1900, p. 636.

Quite variable as to size, form and degree of solidity. Towards its northern range, it is often large, long oval and solid. In Florida it is more delicate, thin and shorter. Lea's *Anodonta dunlapiana* may stand possibly as a variety, though it blends almost imperceptibly into other variations.

ANODONTA COUPERIANA Lea.

Shell more or less inflated, thin and fragile, varying from ovate to obovate, inequilateral; beaks compressed in young or small specimens with rather delicate, subconcentric undulations, full but not much elevated in old shells; anterior end rounded; hinge line lightly arched; dorsal slope obliquely truncated to the posterior point, which is placed on or near the median line; base rounded, often full behind the middle; surface with light concentric striæ; epidermis straw-color, yellow or yellowish-green, generally with beautiful undulated rays; nacre bluish, usually purple-tinted and iridescent.

Length 70, height 40, diam. 28 mm.

Length 98, height 55, diam. 39 mm.

Georgia and Florida.

Type locality, Hopeton, near Darien, Ga.

Anodonta cowperiana LEA, Pr. Am. Phil. Soc., I, 1840, p. 289.

Anodonta couperiana LEA, Tr. Am. Phil. Soc., VIII, 1842, p. 227, pl. XX, fig. 46; Obs., III, 1842, p. 65, pl. XX, fig. 46.—CLESSIN, Conch. Cab. Ano., 1874, p. 148, pl. L, figs. 3, 4.—SIMPSON, Pr. U. S. Nat. Mus., XV, 1892, p. 433, pl. LXXIV, fig. 1.

Margaron (Anodonta) couperiana LEA, Syn., 1852, p. 51; 1870, p. 81.

Anodonta cooperiana PETEL, Conch. Sam., III, 1890, p. 178.

Anodonta gibbosa (part), SIMPSON, Syn., 1900, p. 636.

This species has been believed to be synonymous with *A. gibbosa* Say and at the time of publishing the Synopsis I shared this opinion. I believe now that it is a valid species nearer to *A. dunlapiana* Lea. The beaks are flattened off more or less at all stages of growth, though in large specimens they are full. It grows to a larger size than the above dimensions but, so far as I have seen, is a smaller species than either *gibbosa* or *dunlapiana*.

Group of *Anodonta suborbiculata*.

Shell large, compressed, suborbicular, somewhat produced near the center of the base, rounded in front and bluntly pointed behind, with a slight posterior dorsal wing; beaks flattened, the sculpture consisting of a few irregular ridges, which are generally broken into nodules, sometimes only corrugated; a well-defined, but low, posterior ridge separates the smooth, shining area in front from a darker and rougher one behind; epidermis with numerous delicate, capillary rays near the beaks; muscle scars very large; nacre rather coppery and iridescent; pallial line broken, often marked with radiating ridges. Animal unknown.

ANODONTA SUBORBICULATA Say.

Shell large, irregularly short ovate, thin but strong, gaping in front and behind, subinflated, with low beaks, which are compressed in young shells but fuller in old ones, their sculpture a few irregular, feeble undulations, each bar usually having small, sharp tubercles, these tubercles form two imperfectly radiating rows; dorsal line somewhat curved, ending in front and behind in a small wing or angle; dorsal slope truncated, its outline incurved just above the low posterior ridge; the rounded posterior point about at the median line; base line rounded; anterior end rounded, sometimes cut away a little below; surface smooth and shining in young shells, pale, yellow-green, beautifully and delicately rayed, with three broad rays behind; in old shells the outer growth is concentrically sculptured and the epidermis is smoky or ashy, often banded and nearly or quite rayless; nacre silvery and iridescent, tinted bluish or purplish.

Length 153, height 120, diam. 55 mm.

Length 170, height 120, diam. 65 mm.

Nebraska; Iowa; Illinois; south to Louisiana.

Type locality, Ponds near the Wabash River.

Anodonta suborbiculata SAY, New Harm. Diss., (newspaper form), January 29, 1831; Am. Conch., I, No. II, 1831, pl. XI.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 18, pl. III, figs. 1, 1*a*.—CLESSIN, Conch. Cab. Ano., 1874, p. 160, pl. LII, figs. 1, 2.—SIMPSON, Syn., 1900, p. 636.

Margarita (Anodonta) suborbiculata LEA, Syn., 1836, p. 52; 1838, p. 31.

Anodon suborbiculata CATLOW and REEVE, Conch. Nom., 1845, p. 68.

Margaron (Anodonta) suborbiculata LEA, Syn., 1852, p. 51; 1870, p. 81.

Anodon suborbiculatus SOWERBY, Conch. Icon., XVII, 1867, pl. V, fig. 11.

Probably the finest *Anodonta* in the world. When young it is smooth and shining and marked throughout with delicate

rays, with three broad ones at the posterior ridge. The color changes remarkably in the old shells, being ashy or tawny with a decidedly smoky tint and often widely banded with darker color. The nacre is remarkably brilliant, more so perhaps than in any other *Anodonta,* and it has a very rich, silvery, iridescent sheen. Young shells in unfavorable situations are sometimes colored like the old ones.

Group of *Anodonta woodiana.*

Shell oval, inflated, sometimes narrowed in front, pointed behind, and often a little produced at the posterior base, slightly winged in the post-dorsal region; beaks full, sculptured with numerous strong, concentric ridges, which are either straight in the center of the disk or slightly doubly looped. There is often a faint posterior ridge, which may be double, making the shell biangulate behind; dorsal scars one or two under the beaks; muscle scars irregular.

Animal having the gills large, equal in size, rounded below, free the greater part of their length from the abdominal sac, somewhat wrinkled; marsupium occupying the entire outer gills, forming thick, brown pads when filled; palpi large, subelliptical, free from the mantle a long way; mantle having a wide, thickened edge; branchial opening crowded with dark papillæ; anal opening with no papillæ, but having purple ridges inside; superanal opening closed nearly its whole length.

ANODONTA WOODIANA (Lea).

Shell irregularly elliptical, ovate or obovate, subinflated, generally rather strong, with a low, sometimes slightly double, posterior ridge, which ends behind on the median line; beaks full, generally but slightly elevated, their sculpture a number of parallel ridges, which spread a little behind. These ridges are sometimes nearly straight, or they may be a little curved or feebly doubly looped; dorsal line curved, bounding a wing behind, and generally ending in an angle in front; dorsal slope truncated, the line often incurved; post-ventral part of the shell

strongly and often angularly produced; surface with concentric striæ or ridges; epidermis yellow-green, olive or brownish, often rayed; nacre bluish or purplish, sometimes salmon-tinted, frequently lurid and blotched in the cavities.

Length 120, height 82, diam. 45 mm.
Length 165, height 107, diam. 60 mm.
Length 190, height 135, diam. 80 mm.
Length 150, height 110, diam. 67 mm.

China; Cambodia; Siam; Amoor River?

Symphynota woodiana LEA, Tr. Am. Phil. Soc., V, 1834, p. 42, pl. v, fig. 13; Obs., I, 1834, p. 154, pl. v, fig. 13.

Margarita (Anodonta) woodiana LEA, Syn., 1836, p. 48; 1838, p. 29.

Anodon woodiana SOWERBY, Conch. Icon., XVII, 1870, pl. XXXVI, fig. 149.

Anodonta woodiana CLESSIN, Conch. Cab. Ano., 1875, p. 146, pl. XLVIII, figs. 1, 2.—SIMPSON, Syn., 1900, p. 637.

Margaron (Anodonta) woodiana LEA, Syn., 1852, p. 47; 1870, p. 75.

Symphynota magnifica LEA, Tr. Am. Phil. Soc., V, 1834, p. 42, pl. v, fig. 14; Obs., I, 1834, p. 155, pl. v, fig. 14.

Margarita (Anodonta) magnifica LEA, Syn., 1836, p. 48; 1838, p. 29.

Anodonta magnifica CHENU, Man., 1859, II, p. 146, fig. 719.—SCHRENCK, Reis and F. Am. Lande., II, 1867, p. 718, pl. XXVIII, figs. 1, 2.

Anodon magnifica SOWERBY, Conch. Icon., XVII, 1870, pl. XXV, fig. 96.

Margaron (Anodonta) magnifica LEA, Syn., 1852, p. 47; 1870, p. 75.

? Anodonta aurata KUSTER, Conch. Cab. Ano., 1853, p. 30, pl. VI, fig. 2.

? Anodon rotundatus SWAINSON, Ex. Conch., 2d ed., 1841, pl. XXXVII.

Anodon gibbum BENSON, Jl. Asiat. Soc., XXIV, 1855, p. 135.

Anodon gibba SOWERBY, Conch. Icon., XVII, 1867, pl. VI, fig. 13.—HEUDE, Conch. Fl. Nank., VII, 1881, pl. LI, fig. 95.

Margaron (Anodonta) gibba LEA, Syn., 1870, p. 81.—VON MARTENS, Nov. Conch., IV, 1876, p. 159, pl. CXXXVI, figs. 6, 7.

Anodonta gibba CLESSIN, Conch. Cab. Ano., 1875, p. 181, pl. LX, fig. 4.

Anodon tricostatus SOWERBY, Conch. Icon., XVII, 1870, pl. XXV, fig. 98.

Anodonta edulis HEUDE, J. de Conch., XXII, 1874, p. 117.

Anodon edulis HEUDE, Conch. F. Nank., I, 1875, pl. VIII, fig. 18.

Anodon securiformis HEUDE, Conch. F. Nank., III, 1877, pl. XVIII, fig. 39.

Anodonta securiformis PÆTEL, Conch. Sam., III, 1890, p. 167.

Anodon nigricans HEUDE, Conch. F. Nank., III, 1877, pl. XIX, fig. 41.

Anodonta nigricans PÆTEL, Conch. Sam., III, 1890, p. 182.

Anodon piscatorum HEUDE, Conch. F. Nank., IV, 1878, pl. XXVI, fig. 56.

Anodon elliptica HEUDE, C. F. Nank., IV, 1878, pl. XXVII, fig. 58.

Anodon fusca HEUDE, C. F. Nank., IV, 1878, pl. XXVIII, fig. 59.

Anodon friniana HEUDE, C. F. Nank., IV, 1878, pl. XXVIII, fig. 60.

Anodon joreti HEUDE, C. F. Nank., IV, 1878, pl. XXIX, fig. 62.

Anodon striata HEUDE, C. F. Nank., IV, 1878, pl. XXX, fig. 63.

Anodonta striata PÆTEL, Conch. Sam., III, 1890, p. 185.

Anodon pacifica HEUDE, C. F. Nank., IV, 1878, pl. XXXII, fig. 66.

Anodon tumida HEUDE, C. F. Nank., V, 1879, pl. XXXV, fig. 69.

Anodonta tumida PÆTEL, Conch. Sam., III, 1890, p. 186.

Anodon subtetragona HEUDE, C. F. Nank., V, 1879, pl. XXXVI, fig. 70.

Anodon lineata HEUDE, C. F. Nank., V, 1879, pl. XXXVI, fig. 71.

Anodonta lineata PÆTEL, Conch. Sam., III, 1890, p. 181.

Anodon irregularis HEUDE, C. F. Nank., V, 1879, pl. XXXVII, fig. 73.

Anodonta irregularis PÆTEL, Conch. Sam., III, 1890, p. 180.

Anodon melanochlorea HEUDE, C. F. Nank., V, 1879, pl. XXXVIII, fig. 74.

Anodonta melanochlorea PÆTEL, Conch. Sam., III, 1890, p. 182.

Anodon agricolarum HEUDE, C. F. Nank., V, 1879, pl. XXXIX, fig. 75.

Anodonta agricolarum PÆTEL, Conch. Sam., III, 1890, p. 176.

Anodon mingorum HEUDE, C. F. Nank., V, 1879, pl. XL, fig. 77.

Anodonta mingorum PÆTEL, C. Sam., III, 1890, p. 182.

Anodon bigibba HEUDE, C. F. Nank., VI, 1880, pl. XLI, fig. 78.

Anodonta bigibba PÆTEL, C. Sam., III, 1890, p. 177.

Anodon despecta HEUDE, C. F. Nank., V, 1880, pl. XLI, fig. 79.

Anodon obtusa HEUDE, C. F. Nank., VI, 1880, pl. XLII, fig. 80.

Anodon navicella HEUDE, C. F. Nank., VI, 1880, pl. XLII, fig. 81.

Anodonta navicella PÆTEL, C. Sam., III, 1890, p. 182.

Anodon orbicularis HEUDE, C. F. Nank., VI, 1880, pl. XLII, fig. 82.

Anodonta orbicularis PÆTEL, C. Sam., III, 1890, p. 182.

Anodon livida HEUDE, C. F. Nank., VI, 1880, pl. XLIII, fig. 84.

Anodonta livida PÆTEL, C. Sam., III, 1890, p. 181.

Anodon castanea HEUDE, C. F. Nank., VI, 1880, pl. XLIII, fig. 85.

Anodonta castanea PÆTEL, C. Sam., III, 1890, p. 177.

Anodon succinea HEUDE, C. F. Nank., VI, 1880, pl. XLIV, fig. 87.

Anodonta succinea PÆTEL, C. Sam., III, 1890, p. 185.

Anodon cheniana HEUDE, C. F. Nank., VI, 1880, pl. XLV, fig. 88.

Anodonta cheniana PÆTEL, C. Sam., III, 1890, p. 177.

Anodon scaphydium HEUDE, C. F. Nank., VI, 1880, pl. XLVI, fig. 89.

Anodonta scaphidium PÆTEL, C. Sam., III, 1890, p. 184.

Anodon puerorum HEUDE, C. F. Nank., VII, 1880, pl. XLVII, fig. 90.

Anodonta puerorum PÆTEL, C. Sma., III, 1890, p. 183.

Anodon indecora HEUDE, C. F. Nank., VI, 1880, pl. XLVIII, fig. 91.
Anodonta indecora PÆTEL, C. Sam., III, 1890, p. 180.
Anodon sorini HEUDE, C. F. Nank., VII, 1881, pl. XLIX, fig. 92.
Anodonta sorini PÆTEL, C. Sam., III, 1890, p. 185.
Anodon rosea HEUDE, C. F. Nank., VII, 1881, pl. L, fig. 93.
Anodonta rosea PÆTEL, C. Sam., III, 1890, p. 184.
Anodon aubreyi HEUDE, C. F. Nank., VII, 1881, pl. LII, fig. 97.
Anodonta aubreyi PÆTEL, C. Sam., III, 1890, p. 176.
Anodon confusa HEUDE, C. F. Nank., VII, 1881, pl. LIII, fig. 99.
Anodonta confusa PÆTEL, C. Sam., III, 1890, p. 178.
Anodon obturata HEUDE, C. F. Nank., VII, 1881, pl. LIV, fig. 100.
Anodon rubella HEUDE, C. F. Nank., VII, 1881, pl. LIV, fig. 100 bis.
Anodonta rubella PÆTEL, C. Sam., III, 1890, p. 184.
Anodon florida HEUDE, C. F. Nank., VII, 1881, pl. LV, fig. 102.
Anodonta florida PÆTEL, C. Sam., III, 1890, p. 179.
Anodonta retusa HEUDE, J. de Conch., XXXII, 1884, p. 20.
Anodon intermerata HEUDE, C. F. Nank., IX, 1885, pl. LXVII, fig. 130.
Anodonta intermerata PÆTEL, C. Sam., III, 1890, p. 180.
Anodon filippiana HEUDE, C. F. Nank., IX, 1885, pl. LXVIII, fig. 131.
Anodonta filippiana PÆTEL, C. Sam., III, 1890, p. 183.
Anodon fantozatiana HEUDE, C. F. Nank., IX, pl. LXIX, fig. 132.
Anodonta fantozatiana PÆTEL, C. Sam., III, 1890, p. 179.

Fischer has made a subgenus *Pteranodon* (Man. Conch., p. 1003) for *Anodonta magnifica*, but I do not see any need of giving it and the related species any higher rank than that of a group. The shell and animal differ but little from those of other Anodontas.

I have united under Lea's name, *Anodonta woodiana*, a large number of nominal species, the greater part of which

were made by Pere Heude. The species is evidently an abundant and widespread one in China and consequently variable, but I have not included in it a greater diversity of forms than I have placed under *Anodonta cygnea* or *A. grandis*. The National Museum possesses a good series of this material, all of Lea's, a very good set from the Morelet collection, which came from and was labeled by Heude, and a considerable number of specimens obtained from various other sources. *Anodonta woodiana* is considerably more elongated and is darker and less rayed than *A. magnifica*, but the above mentioned series shows every connecting link between them. It is possible that when more complete series of shells from this region are gathered together and we have a better knowledge of the geographical distribution of these variations some of them may take rank as geographical races or varieties, but with such knowledge as I have I am not qualified to mark out such varieties. Kobelt claims that *A. woodiana* occurs in Japan, but his shell is, I think, a form of *A. lauta* and not Lea's species. *A. woodiana* is characterized by its full beaks with sculpture that spreads posteriorly, its feebly biangulate posterior point on the median line and generally the subangular post-median basal swelling. The nacre is usually rather bright for an *Anodonta*.

ANODONTA RICHTHOFENI Neumayr.

"Shell large, thin, inequilateral, egg-shaped, very much inflated, regularly rounded in front, wider behind, dorsal margin almost straight, slightly curved anteriorly, winged behind; basal margin rounded; posterior margin straight, oblique, posterior end somewhat pointed. Beaks flat, wrinkled; the greatest diameter is nearly under the beaks, so that the shell is very greatly inflated, from there is a gradual slope to the ends and basal margin. Epidermis olive-green, radiate, posteriorly and toward the beaks darker. Nacre yellowish.

Length 123, height 78, diam. 55 mm." (Neumayr.)

Type locality, region of Tsching-kiang, Province of Kiang-su, China.

Anodonta richthofeni NEUMAYR, Ergebnisse d. Reise Szecheny Ostasien, II, 1898, p. 646, pl. 1, fig. 1.

"There has been described from China a considerable number of large Anodontas, which are related to each other and to *An. richthofeni*. It is possible that one working at leisure and with a greater amount of material would find many connecting links and be able to unite many forms as varieties of a common type, but for me, with the small amount of material that I have, this is impossible; I must follow the accepted systematic arrangement and deal with the species in accordance with it. *An. richthofeni* agrees with none of the described species; from *An. edulis* Heude it differs by its greater thickness, more inflated umbonal region and better developed wing. *An. securiformis* Heude appears still nearer, but the inflation of the umbonal region is smaller, the beaks project more forward, and are not wrinkled, the antero-dorsal angle is more marked and the wing less developed. *An. pacifica* Heude is proportionately less high, has smooth beaks and a reddish-brown epidermis. *An. tumida* Heude is proportionally inflated, the epidermis is olive-brown and the nacre has flesh-colored and violet bands. *An. succinea* Heude has sharp, smooth beaks, keeled posterior slope, a sharp pointed hinder end and a chestnut-colored epidermis. *An. scaphidium* Heude and *puerorum* Heude differ entirely."

Probably one of the many mutations of *A. woodiana*.

ANODONTA FENOUILII (Heude).

Shell rather short, subinflated, subovate, with a well-developed dorsal wing, which joins the incurved truncation of the posterior slope with a decided angle; posterior ridge low, feebly double, ending in a wide biangulation on the median line; beaks low, their sculpture not seen, but described by the author of the species as obscurely sulcate and widely corrugated; surface with strongly marked growth lines; epidermis brownish or ashy-brown, rayless; nacre lurid whitish, remarkably thickened in front, especially outside the pallial line, the

thickening suddenly terminating at the subangular center of the base.

Length 100, height 65, diam. 40 mm.

Lake of Yun-nan-fou, China.

Anodon fenouilii Heude, C. F. Nank., IV, 1878, pl. xxxi, fig. 64.

Anodonta fenouilii Simpson, Syn., 1900, p. 639.

This shell is sometimes almost rhomboid in outline and is remarkable for the great and sudden thickening of the front half of the nacre. It seems to bear about the same relation to *A. woodiana* that *A. implicata* does to *A. cataracta.*

Anodonta jourdyi Morlet.

Shell large, irregularly obovate, inflated below the beaks, from which point to the posterior end it is wedge-shaped, inequilateral, subsolid, strongly concentrically striate; post-dorsal wing well developed, truncate with an incurved outline behind; the wide, biangular posterior point of the shell is on the median line; base and anterior end rounded, the latter cut away below, and slightly angled above; beaks full, raised a little above the dorsal line with longitudinal, undulated ridges; epidermis pale green and rayed in the young shells, brownish-green when old; nacre bright salmon, shining.

Length 157, height 108, diam. 54 mm.

Tonkin.

Anodonta jourdyi Morlet, J. de Conch., XXXIV, 1886, pp. 76, 288, pl. xv, figs. 1, 1*a*.—Simpson, Syn., 1900, p. 639.

Evidently closely related to *A. woodiana.* It seems to be less inflated than that species, to be more decidedly wedge-shaped behind and more cut away at the anterior base.

Anodonta lauta von Martens.

Shell irregularly elliptical obovate, sometimes ovate, thin to rather strong, subinflated, inequilateral; with beaks varying from compressed to full, their sculpture consisting of a number of curved bars, which nearly follow the growth lines and

are sometimes slightly corrugated; dorsal wing only moderately developed, sometimes angled behind, occasionally rounded; posterior slope generally slightly truncated; posterior ridge low, often double and ending in a feeble biangulation behind; epidermis generally brown, occasionally feebly rayed; nacre white, bluish-white, or purplish.

Length 110, height 70, diam. 45 mm.

Japan.

Anodonta lauta VON MARTENS, S. B. Nat. Fr., 1877, p. 117; Abh. Senck. Nat. Ges., X, 1877, p. 152, fig. 1.—KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 434, pl. XXI, fig. 1.—SIMPSON, Syn., 1900, p. 639.

Anodonta woodiana KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 433, pl. XX, fig. 1.

A very variable form distinguished typically by its rather regular, elliptical outline and by its dark, generally rayless, epidermis. The surface has more or less of irregular concentric sculpture. It approaches very close to *A. calipygos* and there are specimens that I can scarcely refer to either species. It is generally less inflated and has lower beaks than that species. Kobelt figured and described a form in the Fauna Japonica Extramarina, which he referred to the *Anodonta woodiana* of Lea. It certainly is not that species, which is much produced at the posterior base and sharp behind. I believe it to be a form of *A. lauta* with compressed beaks.

Var. *rostrata* Kobelt.

More pointed behind, with a stronger, more acutely angled post-dorsal wing, and fuller at the posterior base than the type.

Anodonta lauta var. *rostrata* KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 435, pl. XXII, fig. 1.

Var. *tumens* (Haas).

"A highly inflated form of *A. lautus* Marts., characterized by the strong ridges of the beak-sculpture, which, on the upper part of the disk, become very high and nearly terraced-shaped.

There exist all the intermediate stages between the type form and this subspecies." (Haas.)

Type locality, Yamashiro, Japan.

Anodontites lautus tumens Haas, Ann. Mag. Nat. Hist., (8) VI, 1910, p. 499.

Anodonta japonica von Martens.

Shell long elliptical or subrhomboid, subinflated, rather strong, the dorsal and ventral lines sometimes nearly parallel; beaks low and but little inflated, their sculpture consisting of a number of bars, which nearly follow the growth lines; posterior ridge low and rounded, sometimes slightly double, and in that case ending in a feeble biangulation behind; the posterior point is generally a little below the median line; surface with fine, irregular growth lines; epidermis dark brownish, often nearly black, lighter in the umbonal region, subshining, in the young shell, often clouded with green and faintly rayed; nacre bluish-white or purplish, sometimes salmon-tinted.

Length 77, height 45, diam. 30 mm.

Length 73, height 44, diam. 33 mm.

Japan.

Anodonta japonica von Martens in Clessin, Conch. Cab. Ano., 1874, p. 144, pl. xlvii, figs. 3, 4.—Kobelt, Abh. Senck. Nat. Ges., XI, 1879, p. 436, pl. xxii, fig. 3.—von Ihering, Abh. Senck. Nat. Ges., XVIII, 1893, p. 150, fig. 2.—Simpson, Syn., 1900, p. 640.

Anodonta cellensis Kobelt, Abh. Senck. Nat. Ges., XI, 1879, p. 437, pl. xxii, fig. 4.

Anodonta kobelti von Ihering, Abh. Senck. Nat. Ges., XVIII, 1893, p. 152, fig. 1.

Anodonta haconensis von Ihering, Abh. Senck. Nat. Ges., XVIII, 1893, p. 153, fig. 3.

This species is rather a compact one, with low beaks, a dark, somewhat shining epidermis and bright, variously tinted nacre. *Anodonta haconensis* von Ihering, figured as *A. cellensis* by

Kobelt, seems to me to be but a slightly abnormal *A. japonica*, in which the beaks and anterior dorsal region are drawn forward and upward.

ANODONTA LUCIDA (Heude).

Shell oval or elliptical, subcompressed, inequilateral, with low, somewhat flattened beaks, whose sculpture is not known; posterior ridge well developed, subangular above, becoming feebly double below and ending behind about on the median line; dorsal line gradually curved down to the posterior point, the dorsal wing scarcely developed; upper anterior margin angled; surface concentrically sculptured; epidermis shining, fuscous; nacre silvery, shining.

Length 75, height 40, diam. 20 mm.

Siang and Lo Rivers, Hou-nan, China.

Anodon lucida HEUDE, C. F. Nank., III, 1877, pl. XX, fig. 43.

Anodonta lucida SIMPSON, Syn., 1900, p. 640.

The compressed beaks and strong, concentric sculpture as well as the decidedly rounded base, which is a little full behind the middle, distinguish this from *A. rivularis*.

ANODONTA RIVULARIS (Heude).

Shell subrhomboid, or subovate, somewhat elongated, inflated, inequilateral, with high, full beaks, which appear from the figure to have concentric sculpture; posterior ridge strong, upcurved in the middle, ending behind in a point below the median line; posterior dorsal line regularly curved from the beaks to the posterior end; base line slightly curved; upper anterior margin angled; growth lines well marked and crossed by faint, radial grooves, leaving the surface somewhat reticulated; nacre whitish or fuscous, maculated.

Length 70, height 50, diam. 40 mm.

Lieou-ngan-tch' eou and Ning-kouo, China.

Anodon rivularis HEUDE, C. F. Nank., III, 1877, pl. XX, fig. 44.

Anodonta rivularis PÆTEL, C. Sam., III, 1890, p. 184.—SIMPSON, Syn., 1900, p. 640.

Greatly inflated according to Heude's measurements. His very inadequate description in Latin gives no account of the color of the shell. Its high, full beaks and reticulated sculpture are good characters.

ANODONTA HARLANDI Baird and Adams.

Shell irregularly elliptical, slightly inequilateral, with moderately full, raised beaks, which are longitudinally or subconcentrically sulcate; posterior ridge generally double, ending in a feeble biangulation on the median line; base line rounded, a little full behind the middle; anterior end rounded, its upper part angled; from the beaks to this angle the dorsal line is slightly incurved; surface with well-marked, concentric growth lines, brownish-olive, rarely feebly rayed; nacre salmon, whitish or violet-tinted.

Length 70, height 45, diam. 40 mm.

China.

Anodonta harlandi BAIRD and ADAMS, Pr. Zool. Soc. Lond., 1867, p. 492, pl. XXVI, figs. 3, 3*a*.—SIMPSON, Syn., 1900, p 640.

Anodon harlandi HEUDE, C. F. Nank., IV, 1878, pl. XXV, fig. 55.

Anodon limosa HEUDE, C. F. Nank., VI, 1880, pl. XLIII, fig. 83.

Anodonta limosa PÆTEL, C. Sam., III, 1890, p. 181.

Anodon minuta HEUDE, C. F. Nank., VI, 1880, pl. XLIV, fig. 86.

Anodonta minuta PÆTEL, C. Sam., III, 1890, p. 182.

Anodon pulchella HEUDE, C. F. Nank., VII, 1881, pl. LV, fig. 101.

Anodonta pulchella PÆTEL, C. Sam., III, 1890, p. 183.

Anodon pumila HEUDE, C. F. Nank., V, 1879, pl. XXXVII, fig. 72.

Anodonta pumila PÆTEL, C. Sam., III, 1890, p. 183.—SIMPSON, Syn., 1900, p. 640.

A form, which seems to be abundant and somewhat variable. In the Synopsis I placed Heude's *A. pulchella*, *A. limosa* and *A. minuta* in the synonymy of *A. woodiana*, though I felt a little doubtful whether they should go there. They all show

the incurved line from the beaks to the anterior point, and all have the same general form as *harlandi* and I now place them here. *A. pumila* is probably a young shell of this species.

ANODONTA GLOBOSULA (Heude).

Shell short elliptical, greatly inflated, subequilateral, with full, high beaks, which are strongly sulcated; posterior ridge high, subangular, ending in a point below the median line; dorsal wing low, angular behind; dorsal anterior line nearly straight, ending in front in an angle; surface slightly sulcated; nacre whitish with violet border.

Length 70, height 45, diam. 50 mm.

Rivers and lakes of the basin of Houai, China.

Anodon globosula HEUDE, C. F. Nank., IV, 1878, pl. XXV, fig. 54.

Anodonta globosula SIMPSON, Syn., 1900, p. 640.

Heude says nothing regarding the color or degree of solidity of his shell. It is remarkable for having a greater diameter than height, and for the white nacre bordered with violet.

ANODONTA EUSCAPHYS (Heude).

Shell somewhat elongated, irregularly elliptical, inflated, strong, somewhat inequilateral, with full, high beaks, whose sculpture consists of numerous regular ridges that nearly follow the growth lines; posterior ridge strongly developed, decidedly angled, ending behind a little below the median line; base line nearly straight, a little inflated behind the middle; upper anterior part angled; growth lines strong and irregular; epidermis ashy or smoky brown, having darker bands; nacre bluish-white.

Length 85, height 40, diam. 36 mm.

Tcheu-Kiang, southwest China.

Anodon euscaphys HEUDE, C. F. Nank., V, 1879, pl. XXXV, fig. 68.

Anodonta euscaphys PÆTEL, C. Sam., III, 1890, p. 179.—SIMPSON, Syn., 1900, p. 640.

A rather small, much inflated, strong species, with a most decided, sharp posterior ridge. There are one or two feeble radial ridges on the posterior slope.

ANODONTA FLUMINEA (Heude).

Shell short, irregularly ovate or elliptical, inflated, slightly inequilateral; beaks only moderately full or high, corrugated; posterior ridge full, subangular; surface subsulcate, greenish brown; nacre bluish, dull and lurid.

Length 75, height 48, diam. 40 mm.

Length 62, height 40, diam. 32 mm.

China.

Anodon fluminea HEUDE, C. F. Nank., III, 1877, pl. XX, fig. 42.

Anodonta fluminea PÆTEL, C. Sam., III, 1890, p. 179.—SIMPSON, Syn., 1900, p. 640.

Anodon torrentis HEUDE, C. F. Nank., IV, 1878, pl. XXIX, fig. 61.

Heude gives a brief and wholly inadequate Latin description of this form. It is a short oval or subelliptical form with a moderately well-developed posterior ridge and dirty nacre. His figure of *A. torrentis* seems to agree very well with his *fluminea* and the dimensions, which I have given in the second line, do not differ in proportion.

ANODONTA DOLIOLUM (Heude).

Shell irregularly elliptical, inflated, thin, nearly equilateral, with rather full beaks, which project slightly above the dorsal line, somewhat corrugated; posterior ridge well developed, subangular and slightly double, ending behind in a sloping feeble biangulation just below the median line; surface with concentric growth ridges; nacre bluish-white.

Length probably 93, height 58, diam. ?

Canal of Yang-tcheou, China.

Anodon doliolum HEUDE, C. F. Nank., IV, 1878, pl. XXVII, fig. 57.

Anodonta doliolum SIMPSON, Syn., 1900, p. 640.

Heude tells nothing of the color of his shell or its external markings. His measurements are evidently wrong, for he says "Long. 33 mill., alt. 60 mill., crass. 65 mill." I do not think, judging from the figure, that its diameter is greater than the height. It is said by its author to be very thin and delicate.

ANODONTA CALIPYGOS Kobelt.

Shell typically rather short, subrhomboid, inflated with beaks, which are full, rounded and rather high in the adult, but often considerably flattened in the younger state, their sculpture consisting of strong ribs, which nearly follow the growth lines; dorsal wing moderately high and angled; the posterior end decidedly and obliquely truncate above; posterior ridge well developed, ending behind at or below the middle of the height in a narrow, feeble biangulation; surface smooth, brownish or blackish, lighter in the umbonal region, often having greenish, concentric bands and faint rays; nacre bluish-white, flesh-color or purple-tinted.

Length 98, height 64, diam. 43 mm.

Length 75, height 50, diam. 42 mm.

Japan.

Anodonta calipygos KOBELT, Abh. Senck. Nat. Ges., XI, 1879, p. 435, pl. XIX, fig. 1—SIMPSON, Syn., 1900, p. 641.

This form seems to almost, if not quite, connect with *A. lauta* through the variety *rostrata*. This species is quite strongly inflated, the greatest diameter being about the middle, and from this point it is wedge-shaped toward the anterior and posterior ends. A dorsal or ventral view shows an almost perfect diamond-shaped outline. It is a smoother, more shining shell than *lauta* and has fuller beaks when adult, though in the young state they are more compressed.

ANODONTA UNDULIFERA Clessin.

Shell irregularly obovate, much inflated, the inflation greatest a little in front of the middle, from which point it is wedge-shaped in front and behind; beaks a little in front of the center, very high and full, their sculpture consisting of ridges, which nearly follow the growth lines and spread a little be-

hind; posterior ridge fully rounded, curved down in the middle, ending in a point behind at the median line; post-dorsal wing high, cut off behind by an incurved truncation; base much rounded; upper anterior part slightly angled; surface with low, wide, concentric ridges, olive-colored; nacre bright, iridescent.

Length 111, height 85, diam. 50 mm.

North China.

Anodonta undulifera CLESSIN, Conch. Cab. Ano., 1876, p. 233, pl. LXXVI, figs. 1, 2.—SIMPSON, Syn., 1900, p. 641.

A large, finely-developed form with very full, high beaks, a decided wing, and low, wide, concentric ridges. It is probably close to *A. woodiana*.

ANODONTA HEUDEI Neumayr.

"Shell thin, inequilateral, approaching elliptical, wider behind, inflated, with strong growth-lines; beaks flat, not prominent, wrinkled, somewhat eroded, situated anteriorly at 1/3 of the length; dorsal margin not very long, quite straight, slightly angled where it passes into the rounded anterior margin; basal margin very slightly curved; posterior margin obliquely truncate. Posterior slope bounded by a distinct keel with two lines above it. Epidermis olive-brown. Nacre yellowish with violet zones." (Neumayr.)

Type locality, unknown.

Anodonta heudei NEUMAYR, Ergebnisse d. Reise Szecheny Osasien, II, 1898, p. 647, pl. 1, fig. 2.

"Although this species has many near relatives, it is not identical with any of them. *Anodonta arcæformis* Heude, though very close, is nearly equilateral, the dorsal margin is much longer and has no posterior ridge. *Anodonta subtetragona* also has great resemblance, but in that the keel bounding the posterior is much stronger and the beaks are not wrinkled."

Group of *Anodonta arcæformis*.

Shell elliptical, with the dorsal and ventral lines parallel, greatly inflated, rounded in front, pointed and having a slight dorsal wing behind; umbonal region full, but the beaks flat-

tened, their sculpture, consisting of numerous ridges, curved in front and nearly following the growth lines, then running backward in an almost straight line and ending at the low posterior ridge.

Animal unknown.

ANODONTA ARCÆFORMIS (Heude).

Shell long elliptical, inflated, with dorsal and ventral lines nearly parallel; posterior ridge low, angled, ending behind in a point on the median line; beaks placed a little in front of the middle, very full but not high, with numerous rather high, strongly curved ridges, parallel with the growth lines in front and running out nearly straight behind; dorsal wing small, truncated obliquely behind; surface with delicate growth lines; epidermis ashy-green with two or three rays on the posterior slope; nacre white, slightly iridescent.

Length 90, height 50, diam. 45 mm.

Canal of Song-Kiang-fou, China.

Anodon arcæformis HEUDE, C. F. Nank., III, 1877, pl. XIX, fig. 40.

Anodonta arcæformis PÆTEL, C. Sam., III, 1890, p. 176.—SIMPSON, Syn., 1900, p. 641.

A remarkably cylindrical form, having full, but not high, beaks.

Var. *flavotincta* von Martens.

"Shell decidedly smaller and proportionately lower. Beaks not projecting at all, broadly flattened, with some undulating ridges; postero-dorsal angle not projecting at all, ventral margin more decidedly curved in front than behind. Epidermis pale grayish-green, somewhat shining, with one or more blackish growth lines. Nacre bluish-white, very shining, with a rather broad dull ochre-yellowish colored zone near the margin.

Length 49, height at beaks 27, at wing 23; diam. 19 mm." (von Martens.)

Type locality, Soeul, Province of Kyoengkwido and Keumgang, near Kongju, Province of Chungchoengdo, Korea.

Anodonta arcæformis var. *flavotincta* VON MARTENS, Zool. Jahrb. Suppl., VIII, 1905, p. 64, pl. 11, fig. 4.

"Compared with other shells of the same size and for its actual size very thick-shelled, and consequently the specimens cannot be considered to be young shells; the peculiar yellow band on the inside is present in all the specimens, though differing in intensity; Heude mentions nothing of the kind in his description of *arcæformis*. The fact that the wing is not angulated at the end, as in Heude's figure and in our specimen, shows that this is not the young of that species, as in the Anodons the rule is settled that in the young the wing is stronger than in the adult.

A very similar specimen is in the Berlin Museum from Ningpo in Central China, but somewhat larger, 54 mm. long, with a darker, greener and rather shining epidermis, the yellow band is clearly shown; this chiefly prevents me from describing *flavotincta* as a species. One specimen from Keumgang has on the posterior half of the shell, near the basal margin, a spot 11 mm. long and 7 mm. high, with six flat, vertical ridges around it, separated only by small grooves; this also appears on the interior of the shell."

Group of *Anodonta grandis*.

Shell oval, inflated, with a slight post-dorsal wing; umbonal region inflated; beak sculpture consisting of several coarse, irregular, often broken, ridges, which are more or less doubly looped and generally nodulous, especially at the bases of the loops; epidermis usually rather smooth.

Animal having the gills large, inner the larger, especially in front, free nearly or quite the entire length of the abdominal sac; palpi large and long; mantle much thickened at the border.

ANODONTA GRANDIS Say.

Shell long ovate, subrhomboid or subelliptical, generally rather strong, subinflated, inequilateral; beaks usually full and more or less elevated above the dorsal line, their sculpture consisting of a few strong, irregular, broken ridges, which are

sharply, doubly looped, the bases of the loops nearly or quite nodulous; posterior ridge full, frequently more or less double and ending behind in a rounded or feebly biangulate point at the median line; post-dorsal wing low, obliterated in old specimens; upper anterior edge either slightly angled or rounded; base line curved; epidermis greenish-brown or brownish-green, rarely faintly rayed, but showing about three broad, dark rays on the posterior slope; beak cavities varying from shallow to moderately deep, not compressed; nacre bluish-white, rarely tinted purple, sometimes a little thickened in front.

Length 135, height 68, diam. 40 mm.

Length 102, height 57, diam. 35 mm.

Length 146, height 72, diam. 57 mm.

Entire Mississippi system; Upper St. Lawrence drainage; Red River of the North; Lake Winnipeg; Manitoba; southwest to Texas; southeast to Pennsylvania?

Type locality, Fox River of the Wabash.

Anodonta grandis SAY, N. Harm. Diss., II, 1829, p. 341.—CLESSIN, Conch. Cab. Ano., 1873, p. 96, pl. XXX, figs. 1, 2.—BAKER, Moll. Chicago, Pt. I, 1898, p. 51, pls. II; III, fig. 1; IV, fig. 1.—SIMPSON, Syn., 1900, p. 641.

Margarita (Anodonta) grandis LEA, Syn., 1836, p. 52; 1838, p. 31.

Anodon grandis SOWERBY, Conch. Icon., XVII, 1870, pl. I, fig. 1.

Margaron (Anodonta) grandis LEA, Syn., 1852, p. 51; 1870, p. 81.

Anodonta ovata LEA, Tr. Am. Phil. Soc., VI, 1838, p. 2, pl. II, fig. 2; Obs., II, 1838, p. 2, pl. II, fig. 2.—CLESSIN, Conch. Cab. Ano., 1874, p. 121, pl. XXXIX, figs. 2, 3.

Margarita (Anodonta) ovata LEA, Syn., 1836, p. 52; 1838, p. 30.

Anodon ovata CATLOW and REEVE, Conch. Nom., 1845, p. 67.

Margaron (Anodonta) ovata LEA, Syn., 1852, p. 50; 1870, p. 80.

Margarita (Anodonta) salmonia LEA, Syn., 1836, p. 51; 1838, p. 30.

Anodonta salmonia Lea, Tr. Am. Phil. Soc., VI, 1838, p. 45, pl. xiv, fig. 41; Obs., II, 1838, p. 45, pl. xiv, fig. 41.

Anodon salmonia Sowerby, Conch. Icon., XVI, 1867, pl. xix, fig. 44.

Margaron (Anodonta) salmonia Lea, Syn., 1852, p. 50; 1870, p. 80.

Anodonta lewisii Lea, Pr. Ac. N. Sci. Phila., I, 1857, p. 84; Jl. Ac. N. Sci. Phila., IV, 1860, p. 362, pl. lxii, fig. 187; Obs., VIII, p. 44, pl. lxii, fig. 187.—Clessin, Conch. Cab. Ano., 1874, p. 143, pl. xlix, figs. 5, 6.

Anodon lewisii Sowerby, Conch. Icon., XVII, 1870, pl. xxxv, fig. 142.

Margaron (Anodonta) lewisii Lea, Syn., 1870, p. 80.

This form sometimes reaches greater dimensions than any given above. The type of Lea's *ovata* is not in the Lea collection, but the figure shows it to be a somewhat elongated shell with a moderate dorsal wing and the figure and dimensions given indicate that it is a young shell. I have seen what I suppose is the type of Say's *A. grandis* and I believe the two are identical. Lea's *A. salmonia* is apparently a stunted form of the above, its nacre having been injured perhaps by a *Trematod*. There seems to be every possible transition between the most elongated forms of *grandis* and the shorter, fuller specimens, which have received such names as *plana*, *gigantea*, *decora*, etc.

Var. *gigantea* Lea.

Shell large, ovate or subrhomboid, a little higher in proportion to the length than the type; beaks full and high.

Length 205, height 115, diam. 80 mm.

Type locality, Port Gibson, Miss.

Anodonta gigantea Lea, Tr. Am. Phil. Soc., 1834, p. 1, pl. 1, fig. 1; Obs., II, 1838, p. 1, pl. 1, fig. 1.—Kuster, Conch. Cab. Ano., 1853, p. 6, pl. 1, figs. 1, 2.

Margarita (Anodonta) gigantea Lea, Syn., 1836, p. 52; 1838, p. 31.

Margaron (Anodonta) gigantea LEA, Syn., 1852, p. 50; 1870, p. 81.

Anodon gigantea SOWERBY, Conch. Icon., XVII, 1867, pl. VIII, fig. 18.

Anodonta grandis var. *gigantea* SIMPSON, Syn., 1900, p. 643.

Anodon giganteus SOWERBY, Conch. Icon., XVII, 1870, pl. XXXVII, fig. 152.

Anodonta plana LEA, Tr. Am. Phil. Soc., V, 1834, p. 48, pl. VII, fig. 18; Obs., I, 1834, p. 160, pl. VII, fig. 18.—CLESSIN, Conch. Cab. Ano., 1874, p. 142, pl. XLVI, figs. 1, 2.

Margarita (Anodonta) plana LEA, Syn., 1836, p. 52; 1838, p. 30.

Anodon plana DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 201, pl. XVII, fig. 232.—SOWERBY, Conch. Icon., XVII, 1869, pl. XXIV, fig. 94.

Margaron (Anodonta) plana LEA, Syn., 1852, p. 50; 1870, p. 80.

Anodonta declivis CONRAD, Am. Jl. Sci., XXV, 1834, pl. 1, fig. 11.

Margarita (Anodonta) decora LEA, Syn., 1836, p. 52; 1838, p. 30.

Anodonta decora LEA, Tr. Am. Phil. Soc., VI, 1838, p. 64, pl. XX, fig. 63; Obs., II, 1838, p. 64, pl. XX, fig. 63.—CLESSIN, Conch. Cab. Ano., 1873, p. 71, pl. XVII, figs. 1, 2.

Anodon decora SOWERBY, Conch. Icon., XVII, 1869, pl. XXI, fig. 83.

Margaron (Anodonta) decora LEA, Syn., 1852, p. 50; 1870, p. 81.

Anodonta harpethensis LEA, Pr. Am. Phil. Soc., I, 1840, p. 289; Tr. Am. Phil. Soc., VIII, 1842, p. 224, pl. XIX, fig. 42; Obs., III, 1842, p. 62, pl. XIX, fig. 42.—CLESSIN, Conch. Cab. Ano., 1876, p. 217, pl. LXXII, figs. 1, 2.

Margaron (Anodonta) harpethensis LEA, Syn., 1852, p. 50; 1870, p. 81.

Anodon harpethensis SOWERBY, Conch. Icon., XVII, 1869, pl. XXI, fig. 82.

Anodon subangulata ANTHONY, Am. Jl. Conch., I, 1865, p. 158, pl. XIII, fig. 1.

Anodonta subangulata, B. H. WRIGHT, Check List, 1888.

Anodon opalina ANTHONY, Am. Jl. Conch., I, 1865, p. 159, pl. XIV, fig. 2.

Anodon menielii ANTHONY, Am. Jl. Conch., II, 1866, p. 144, pl. VI, fig. 1.

Anodon inornata ANTHONY, Am. Jl. Conch., II, 1866, p. 145, pl. VII, fig. 1.

Anodon ovata SOWERBY, Conch. Icon., XVII, 1868, pl. XXII, fig. 85.

Var. *footiana* Lea.

Shell smaller than the typical form, generally rather thin; epidermis ashy, ashy-green or smoky-brown, often tinted with reddish-brown; nacre bluish-white, sometimes with a dull silvery tint.

Length 83, height 47, diam. 30 mm.

Length 130, height 68, diam. 50 mm.

St. Lawrence drainage.

Type locality, vicinity of Fort Winnebago.

Anodonta footiana LEA, Pr. Am. Phil. Soc., I, 1840, p. 289; Tr. Am. Phil. Soc., VIII, 1842, p. 225, pl. XX, fig. 44; Obs., III, 1842, p. 63, pl. XX, fig. 44.—CLESSIN, Conch. Cab. Ano., 1876, p. 227, LXV, fig. 5; pl. LXXIV, fig. 3.—BAKER, Moll. Chicago, Pt. I, 1898, p. 54, pl. III, figs. 2-4; V, fig. 2; VIII, fig. 5.

Margaron (Anodonta) footiana LEA, Syn., 1852, p. 49; 1870, p. 78.

Anodon footiana SOWERBY, Conch. Icon., XVII, 1867, pl. XIV, fig. 48.

Anodonta grandis var. *footiana* SIMPSON, Syn., 1900, p. 642.

Anodonta marryattiana LEA, Pr. Am. Phil. Soc., I, 1840, p. 289.

Anodonta marryattana LEA, Tr. Am. Phil. Soc., VIII, 1842, p. 226, pl. XX, fig. 45; Obs., III, 1842, p. 64, pl. XX, fig. 45.—CLESSIN, Conch. Cab. Ano., 1873, p. 72, pl. XXVI, figs. 3, 4.

Margaron (Anodonta) marryattana Lea, Syn., 1852, p. 51; 1870, p. 82.

Anodon marryattanus Sowerby, Conch. Icon., XVII, 1870, pl. XXVIII, fig. 111.

Anodonta sulcata Kuster, Conch. Cab. Ano., 1873, p. 62, pl. XVIII, fig. 1.

Anodonta nilssonii Kuster, part, Conch. Cab. Ano., 1853, p. 61, pl. XVII, figs. 3, 4.

Anodon imbricata Anthony, Am. Jl. Conch., I, 1865, p. 159, pl. XIV, fig. 1.

Anodonta imbricata B. H. Wright, Check List, 1888.

Anodon subinflata Anthony, Am. Jl. Conch., I, 1865, p. 160, pl. XV, fig. 1.

Anodonta subinflata B. H. Wright, Check List, 1888.

? Anodon edentulus Sowerby, Conch. Icon., XVII, 1867, pl. XVII, fig. 60.

Anodonta houghtonensis Currier, Shell-bearing Moll. Mich., 1881, p. 14, pl. I, fig. 2.

Var. *leonensis* Lea.

Shell smooth, long elliptical, rather widely subbiangulate behind, with a well-developed posterior ridge.

Length 87, height 52, diam. 37 mm.

Texas, possibly north to Kansas.

Type locality, Leon Co., Texas.

Anodonta leonensis Lea, Pr. Ac. N. Sci. Phila., VI, 1862, p. 169; Jl. Ac. N. Sci. Phila., VI, 1866, p. 25, pl. IX, fig. 24; Obs., XI, 1867, p. 29, pl. IX, fig. 24.—Clessin, Conch. Cab. Ano., 1874, p. 131, pl. XLII, figs. 3, 4.

Margaron (Anodonta) leonensis Lea, Syn., 1870, p. 78.

Anodonta grandis var. *leonensis* Simpson, Syn., 1900, p. 643.

Var. *benedictensis* Lea.

Shell shorter than the type, subrhomboid, subinflated to inflated, generally thin.

Length 92, height 57, diam. 37 mm.

St. Lawrence drainage.

Type locality, Lake Champlain.

Symphynota benedictensis Lea, Tr. Am. Phil. Soc., V, 1834, p. 104, pl. xvi, fig. 48; Obs., I, 1834, p. 216, pl. xvi, fig. 48.

Anodonta benedictensis De Kay, Zool. N. Y., Pt. 5, 1843, p. 204, pl. xviii, fig. 235.—Clessin, Conch. Cab. Ano., 1875, p. 163, pl. liv, figs. 1, 2.

Margarita (Anodonta) benedictensis Lea, Syn., 1836, p. 28; 1838, p. 29.

Anodon benedictensis Sowerby, Conch. Icon., XVII, 1870, pl. xxvi, fig. 99.

Margaron (Anodonta) benedictensis Lea, Syn., 1852, p. 47.

Anodonta grandis var. *benedictensis* Simpson, Syn., 1900, p. 644.

Margaron (Anodonta) benedictii Lea, Syn., 1870, p. 75.

Anodonta benedictii Latchford, Tr. Ottawa F. N. Cl., 1882, p. 55.

Anodonta cultrata Gould, in letter.

I have united under the name *Anodonta grandis* of Say a large number of so-called species, retaining as varieties a few forms, which typically have some claims to distinction. There seem to be intermediates between all these forms, which perfectly connect them. Say's *grandis*, of which I have seen what I believe to be the type, is a somewhat elongated form, which agrees very well with Lea's *ovata*. The shell, which Lea figured as the type of his *A. gigantea*, is not in his collection, but it appears to be a slightly diseased individual. In many cases specimens of what I believe to be this form become diseased in the region of the posterior slope, that part becoming thickened, rough and somewhat truncate. The healthy manifestations of this so-called species is larger, more robust, and a little higher in proportion than Say's shell, but I cannot possibly separate it in any other way from *A. decora*, *A. harpethensis* and several others. *A. plana* of Lea is a little more compressed, but I am sure is not worthy of a varietal name. *A. footiana*, which I believe to be identical with *A. marryattana*, is thinner and smaller and has normally a different texture epidermis and often nacre from *A. grandis*, but it is completely

connected with it. *A. benedictensis* is a thin, short form from the lower part of the St. Lawrence System, which I regard as merely a variety.

ANODONTA SUBGIBBOSA (Anthony).

Shell irregularly ovate or elliptical, inflated, thin, somewhat inequilateral, with full, high beaks having the nodulous, doubly-looped ridges characteristic of the group; dorsal line nearly straight, bounding a low wing behind; posterior slope truncated, the truncation meeting the dorsal line at an obtuse angle; base line curved or a little angular in the middle; surface rather finely, unevenly, concentrically striate; epidermis dull, ashy or ashy-green, showing the rest periods; nacre dirty bluish-white.

Length 85, height 60, diam. 46 mm.

Type locality, Black Lake, Michigan.

Anodon subgibbosa ANTHONY, Am. Jl. Conch., II, 1866, p. 144, pl. VI, fig. 2.

Anodonta subgibbosa B. H. WRIGHT, Check List, 1888.

Anodon subgibbosus SOWERBY, Conch. Icon., XVII, 1870, pl. XXVII, fig. 107.

Margaron (Anodonta) subglobosa LEA, Syn., 1870, p. 81.

Anodonta grandis (part), SIMPSON, Syn., 1900, p. 644.

At the time of writing the Synopsis I had never seen what I believed to be an authentic specimen of this species and I was inclined from an examination of Anthony's figure to think it was a mere form of *A. grandis*. Recently I have seen several specimens, and I now believe that the shell is different from *grandis*. Its high, swollen beaks are much like those of *A. corpulenta*, but it is very much smaller than that species, is differently formed, and has not the same texture.

ANODONTA DAKOTA Frierson.

"Shell elliptically rounded before (slightly cut away below); dorsal line nearly straight; base slightly curved. Posterior nearly straight, making the shell trapezoidal in outline. Epidermis straw-yellow, with dark bands marking the rest periods.

Umbonal ridge angular, beaks not high, with double-loop sculpture, as in *Ano. grandis* Say.

Umbos inflated, greatest diameter of the shell about 1/3 from beak to base.

Length 3, height 1.8, diam. 1.6 inches." (Frierson).

Type locality, Ulvers Point, Clear Lake, Deuel Co., South Dakota.

Anodonta dakota FRIERSON, Naut., XXIII, 1910, p. 113, pl. x.

"The beaks ally the shell, of course, to *Anodonta grandis* Say. It is nearest to that form called by Mr. Anthony *A. subgibbosa* (and especially to the figure of this species shown in the Conchologia Iconica, which is much more characteristic than the figure in the American Journal of Conchology). From any form of *Ano. grandis* it differs in being more cylindrical; *i. e.,* in lacking the swelling "amidship" so often shown by *A. grandis;* in being rayless (so far as known), but especially by having its posterior point not elevated above the basal line, and by the marked truncation posteriorly, which truncation is as marked as in *Margaritana marginata* Say, and the straight posterior, and the resulting quadrilateral aspect of the shell. It is more quadrate than *Anodonta doliaris* Lea. The lack of any obliquity is remarkable."

ANODONTA BEALEI Lea.

Shell oblong, irregularly elliptical, thin but strong, subinflated, inequilateral, with full, somewhat elevated beaks, whose sculpture consists of corrugated, doubly-looped ridges that are subnodulous at the bases of the loops; posterior ridge low, ending in a point on the median line behind; dorsal wing low; the posterior slope subtruncate; dorsal and ventral borders nearly parallel; surface nearly smooth; epidermis ashy-brown, banded, greenish in young shells, there being two or three dark rays on the posterior slope, the whole shining; nacre bluish-white, very slightly thickened in front.

Length of type 80, height 42, diam. 30 mm.

Length of larger shell 93, height 50, diam. 35 mm.

Texas to Kansas.

Type locality, Leon County and Verdigris River, Texas.

Anodonta bealei LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 194; Jl. Ac. N. Sci. Phila., VI, 1866, p. 26, pl. IX, fig. 25; Obs., XI, 1867, p. 30, pl. IX, fig. 25.—CLESSIN, Conch. Cab. Ano., 1874, p. 132, pl. XLIV, figs. 5, 6.—SIMPSON, Syn., 1900, p. 644.

Margaron (Anodonta) bealei LEA, Syn., 1870, p. 81.

An elongated, subcylindrical form with shining, ashy-brown epidermis, which is banded and has dark rays on the posterior slope. It may be only a variety of *A. grandis*, but the two shells I have seen seem distinct.

ANODONTA TEXASENSIS Lea.

Shell irregularly obovate, thin, subinflated, with full, high beaks having doubly-looped sculpture, with a well-developed posterior ridge that ends behind in a blunt point on the median line; anterior end somewhat narrowed and rounded; base rounded and considerably produced just behind the middle; dorsal wing low; epidermis smooth, pale yellow, tinted brownish, obscurely rayed; nacre bluish-white, iridescent.

Length 52, height 30, diam. 19 mm.

Type locality, Texas.

Anodonta texasensis LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 113; Jl. Ac. N. Sci. Phila., IV, 1860, p. 366, pl. LXIII, fig. 191; Obs. VIII, 1860, p. 48, pl. LXIII, fig. 191.—CLESSIN, Conch. Cab. Ano., 1873, p. 109, pl. XXXIII, figs. 7, 8.—SIMPSON, Syn., 1900, p. 645.

Anodon texasensis SOWERBY, Conch. Icon., XVII, 1870, pl. XXXVI, fig. 146.

Margaron (Anodonta) texasensis LEA, Syn., 1870, p. 81.

A species of which I have only seen the type, a young shell now so broken that little can be made out from it. It may be the young of some other species. It is decidedly produced just behind the center of the base. Possibly a young *bealei*.

ANODONTA DANIELSII Lea.

Shell oblong, subrhomboid, subcompressed, thin, with beaks rising above the outlines of the shell, having doubly-looped sculpture; posterior ridge low, double, ending in a wide bian-

gulation a little below the median line; surface sculptured with numerous concentric ridges; epidermis dark brown or black, shining or a little dusky; dorsal and ventral lines nearly parallel, the latter a little incurved in the middle; nacre bluish-white, iridescent.

Length 100, height 56, diam. 34 mm.

Type locality, Topeka, Kansas. Also Limestone Gap, Indian Territory.

Anodonta danielsii LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 139; Jl. Ac. N. Sci. Phila., IV, 1860, p. 365, pl. LXIII, fig. 190; Obs., VIII, 1860, p. 47, pl. LXIII, fig. 190.—CLESSIN, Conch. Cab. Ano., 1873, p. 108, pl. XXXIII, figs. 1, 2.—SIMPSON, Syn., 1900, p. 645.

Margaron (Anodonta) danielsii LEA, Syn., 1870, p. 78.

Anodon danielsii SOWERBY, Conch. Icon., XVII, 1870, pl. XXXVI, fig. 148.

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

A thin, concentrically sculptured, very dark form with the base line a little incurved. I found what I have no doubt is this species at Limestone Gap, Indian Territory, in pools in a rocky stream.

ANODONTA OPACA Lea.

Shell long elliptical, subinflated to inflated, moderately strong, inequilateral, with full, high beaks, whose sculpture consists of doubly-looped, nodulous ridges; posterior ridge low, generally double, ending behind in a biangulation at the median line; anterior end rounded, scarcely angled above; posterior wing very low, scarcely angled behind; base line straight or slightly incurved; epidermis dark, smoky or ashy-brown, sometimes banded, subshining; nacre bluish-white, having a soft, silvery tint, sometimes yellowish in the cavity.

Length 108, height 62, diam. 43 mm.

Louisiana; Mississippi; north to Kansas.

Type locality, near New Orleans and Little Rock, Ark.

Anodonta opaca LEA, Tr. Am. Phil. Soc., X, 1852, p. 285, pl. XXV, fig. 46; Obs., V, 1852, p. 41, pl. XXV, fig. 46.—CLESSIN, Conch. Cab. Ano., 1875, p. 209, pl. LXIV, figs. 1, 2.—SIMPSON, Syn., 1900, p. 645.

Margaron (Anodonta) opaca LEA, Syn., 1852, p. 50; 1870, p. 80.

This may be merely a variety of *A. grandis,* but it has a somewhat different texture from any of the forms of that or any other species I know of. It is generally dark and smoky externally, and the nacre has a soft, rich tint that is not often found in the genus. The young shell is sometimes greenish with dark, concentric bands.

ANODONTA STEWARTIANA Lea.

Shell irregularly ovate or subtriangular, somewhat inequilateral, strong, with very high, full beaks, the umbonal swelling extending out on the disks; beak sculpture strongly corrugated, doubly looped and nodulous; posterior wing low, often rounded behind; dorsal slope subtruncate, the outline usually a little incurved; posterior ridge very faint, ending behind in a blunt point at or a little above the median line; upper part of the anterior end generally angled; base line straight or rounded, curved up decidedly behind; surface with irregular growth lines or sulcations, dull or subshining, dirty olive-green to brown, often when fresh having a peculiar grayish tint or bloom, which wears off when the shell is handled; nacre whitish or reddish.

Length 166, height 100, diam. 68. mm.

Length 140, height 95, diam. 68 mm.

Arkansas; Louisiana; Texas.

Type locality, River Teche, La.

Anodonta stewartiana LEA, Tr. Am. Phil. Soc., V, 1834, p. 47, pl. VI, fig. 17; Obs., I, 1834, p. 159, pl. VI, fig. 17.—CLESSIN, Conch. Cab. Ano., 1874, p. 150, pl. XLVIII, figs. 3, 4.—SIMPSON, Syn., 1900, p. 645.

Margarita (Anodonta) stewartiana LEA, Syn., 1836, p. 52; 1838, p. 31.

Anodon stewartiana CATLOW and REEVE, Conch. Nom., 1845, p. 68.

Anodon stewartianus SOWERBY, Conch. Icon., XVII, 1870, pl. XXXII, fig. 133.

Margaron (Anodonta) stewartiana LEA, Syn., 1852, p. 51; 1870, p. 81.

Anodonta virens LEA, Tr. Am. Phil. Soc., X, 1852, p. 290, pl. XXVIII, fig. 53; Obs., V, 1852, p. 46, pl. XXVIII, fig. 53.

Margaron (Anodonta) virens LEA, Syn., 1852, p. 51; 1870, p. 81.

Anodon virens SOWERBY, Conch. Icon., XVII, 1870, pl. XXXIV, fig. 138.

Very close to *A. corpulenta*, but it is generally a little longer in proportion to the height, the posterior point is more elevated, the form is more nearly ovate, and it often has a peculiar, grayish bloom that is not present in *corpulenta*. I have seen specimens, which stand between it and *A. bealei* and others that closely approach *A. opaca*. The type is a young shell and gives no idea of what it is like when adult, but Lea has larger shells with it from the type locality. The type of *A. virens* is a young shell of the same species I think.

ANODONTA CORPULENTA Cooper.

Shell large, subrhomboid, strong or subsolid, inflated, somewhat inequilateral, with excessively full and high beaks, the wide umbonal swelling extending down on the disk; the beak sculpture consists of very irregular corrugations, which are somewhat doubly looped and subnodulous at the base of the loops; posterior ridge low, beginning behind the great umbonal swelling and ending behind in a feeble biangulation below the median line; dorsal wing moderate and short, with a long, oblique truncation behind; anterior end round; base slightly curved; surface with irregular growth-lines, often sulcate; epidermis olive or smoky-brown, sometimes quite dark, often banded, rarely rayed; nacre whitish or dull purplish, often considerably thickened in front.

Length 170, height 108, diam. 77 mm.

Length 175, height 112, diam. 68 mm.

Missouri River; Upper Mississippi River drainage; east to Indiana; Tyler, Texas.?

Type locality, Upper Missouri River.

Anodonta corpulenta COOPER, App. to Narrative, Exp. Miss. to It. L., 1834, p. 154.—SIMPSON, Syn., 1900, p. 646.

Anodon corpulenta SOWERBY, Conch. Icon., XVII, 1870, pl. XXXII, fig. 129.

Margaron (Anodonta) corpulenta LEA, Syn., 1870, p. 81.

A magnificent *Anodonta*, which is generally rather smooth when young, but often becomes dark and rough when old. It is doubtful whether Sowerby's figure in the Conchologia represents this, as it is too long and brightly painted for Cooper's species. There is a very fine specimen in Dr. Lea's collection presented to him by Mr. Cooper under the name *Anodonta corpulenta*, which agrees well with what is generally understood for that species. It appears to be replaced in the South by *A. stewartiana*.

ANODONTA LINNEANA Lea.

Shell unevenly elliptical, inflated, thin or slightly thickened, with very full, high beaks placed nearly in the center of the shell, their sculpture a double row of tubercles, which are sometimes developed from doubly-looped ridges; anterior end rounded; dorsal line curved, angled a little in front, with a low wing behind; posterior slope somewhat truncated; the shell ends behind in a feeble biangulation just below the median line; epidermis greenish in young shells, brownish in adult specimens, often banded, with two or three rays on the posterior slope, not very smooth but slightly shining; nacre bluish, purplish-white or salmon-color, bright, iridescent behind.

Length 100, height 65, diam. 44 mm.

Type locality, Lake Concordia, Louisiana. Also Colorado River, Texas.

Anodonta linneana LEA, Tr. Am. Phil. Soc., 1852, p. 289, pl. XXVII, fig. 51; Obs., V, 1852, p. 45, pl. XXVII, fig. 51.—CLESSIN, Conch. Cab. Ano., 1874, p. 117, pl. XXXVI, figs. 5, 6.—SIMPSON, Syn., 1900, p. 646.

Margaron (Anodonta) linneana LEA, Syn., 1852, p. 51; 1870, p. 81.

Anodon linneanus SOWERBY, Conch. Icon., XVII, 1870, pl. XXXV, fig. 144.

The type is badly broken, but it does not seem to me to stand for the fine species which Lea thought *linneana* was. Two specimens have since been received by the National Museum from Mr. Askew from the Colorado River, Texas, one of which is larger, heavier and considerably darker than Lea's shell, and is probably adult. It is more nearly elliptical and less drawn out behind than *A. stewartiana* and is more nearly equilateral. *A. virens* is shaped something like this, but it is no doubt a young shell. Its nacre is not brilliant like that of *linneana*.

ANODONTA GLOBOSA Lea.

Shell large, greatly inflated, with high, full and much elongated beaks and umbonal swelling, irregularly elliptical, thin, gaping when adult, beak sculpture doubly looped and subnodulous; posterior ridge low, ending behind in a blunt or rounded point above the median line; surface smooth, bright green, banded and faintly rayed when young, grayish-green when old, having three broad rays on the posterior slope; nacre bluish-white, of a brilliant silvery luster and iridescent.

Length 190, height 140 mm.

Length (Lea's type of *A. globosa*) 100, height 72, diam. 52 mm.

Mexico.

Margarita (Anodonta) globosa LEA, Syn., 1836, p. 52.

Anodonta globosa LEA, Pr. Am. Phil. Soc., II, 1841, p. 31; Tr. Am. Phil. Soc., VIII, 1842, p. 241, pl. XXIV, fig. 56; Obs., III, 1842, p. 79, pl. XXIV, fig. 56.—CLESSIN, Conch. Cab. Ano., 1875, p. 213, pl. LXV, figs. 3, 4.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 529, pl. LXVIII, figs. 1, 1*a*.—SIMPSON, Syn., 1900, p. 646.

Anodon globosa SOWERBY, Conch. Icon., XVII, 1870, pl. XXXV, fig. 141.

Margaron (Anodonta) globosa LEA, Syn., 1852, p. 51; 1870, p. 81.

Anodon nopalatensis SOWERBY, Conch. Icon., XVII, 1867, pl. XVI, fig. 58.—CLESSIN, Conch. Cab. Ano., 1876, p. 223, pl. LXXIII, fig. 3.

Margaron (Anodonta) nopalatensis LEA, Syn., 1870, p. 81.

A magnificent species of the largest size. The posterior point is higher than it is in *tabascensis*, the great swelling of the beaks and umbonal region is much longer than it is in that species. Lea's *globosa* is, I am sure, a young specimen of Sowerby's *nopalatensis* and his name has priority.

ANODONTA TABASCENSIS Morelet.

Shell large, slightly inequilateral, much inflated, irregularly elliptical, thin, with very full, high beaks, whose sculpture consists of a few nodulous, doubly-looped ridges; anterior upper part angulated; post-dorsal part developed into a small wing, which meets the truncation of the posterior slope at an angle; posterior ridge low, ending in a narrow biangulation at the median line; surface finely, concentrically striate; epidermis smooth and shining, grayish-green, with two or three wide rays on the posterior slope; interior bluish-white, iridescent.

Length 150, height 110 mm.

Length 156, height 116, diam. 80 mm.

Tabasco, Mexico.

Anodonta tabascensis MORELET, Jl. de Conch., XXXII, 1884, p. 124.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 530, pl. LXII, fig. 1.

Anodonta tabascoensis SIMPSON, Syn., 1900, p. 646.

Several fine shells were recently received by the National Museum from Montecristo, Tabasco, Mexico, which I refer to this species. They are a little higher in proportion to length than the shell figured by Fischer and Crosse, and fuller in the post-basal region, but the difference is not great. It is a magnificent species and is nearest to *A. globosa* Lea, but the beaks and umbonal swelling are not so much lengthened as they are in that species, and the basal line is more rounded.

ANODONTA MICANS (Anthony).

Shell elliptical or ovate, scarcely inflated, smooth, inequilateral, thin; beaks flattened, scarcely raised above the dorsal line with apparently few, if any, undulations; epidermis smooth, brownish-olive, wrinkled or striate; posterior ridge low, double, ending behind in a wide biangulation about on the median line; anterior muscle scars impressed; nacre a brownish-golden color over the whole interior and very iridescent.

Length, 70, height 40, diam. 24 mm.

Type locality, Texas.

Anodon micans ANTHONY, Am. Jl. Conch., I, 1865, p. 162, pl. XVI, fig. 1.

Anodonta micans B. H. WRIGHT, Check List, 1888.—SIMPSON, Syn., 1900, p. 647.

Margaron (Anodonta) micans LEA, Syn., 1870, p. 78.

I know nothing of this species aside from the description and figure of its author. It resembles externally some specimens of *A. simpsoniana*, but is more decidedly biangulate behind, and has, according to the author, a much richer nacre.

ANODONTA LURULENTA Morelet.

Shell subrhomboid, slightly inequilateral, thin, convex, with a well-developed, though not high, dorsal wing, which ends in an angle behind at the posterior truncation of the shell; posterior ridge low, ending near the base behind in a rounded point; beaks rather low but apparently sharp, their sculpture not seen; anterior half of the shell brilliant; posterior half sublamellous; color of epidermis green or olive; nacre blue, iridescent.

Length 53, height 31, diam. 19 mm.

Guatemala; Yucatan.

Anodonta lurulenta MORELET, Test. Nov., Pt. 1, 1829, p. 28.—FISCHER and CROSSE, Miss. Sci., II, 1894, p. 523, pl. LXIV, figs. 6, 6*a*.—SIMPSON, Syn., 1900, p. 647.

I suspect that this is a young shell, but the rhomboid form and the difference between the smoothness of the anterior and posterior parts of the shell would seem to distinguish it from other species.

ANODONTA KENNICOTTII Lea.

Shell long, elliptical, ovate or subrhomboid, inequilateral, convex, strong, with a well-developed, rounded or subangular posterior ridge, which curves upward in the middle, is rarely double, and ends in a blunt point below the median line; beaks almost conpressed, elevated but little above the dorsal line, rather sharp, their sculpture consisting of uneven, somewhat doubly-looped, nodulous ridges, surface scarcely smooth, dull greenish or ashy-brown, exhibiting the rest periods quite distinctly; nacre dirty bluish-white.

Length 107, height 54, diam. 32 mm.

Length 80, height 47, diam. 31 mm.

Upper and middle St. Lawrence River System; northwest into the Mackenzie drainage.

Type locality, Fort Rae, Great Slave Lake and north end of Lake Winnipeg.

Anodonta kennicottii LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 56; Jl. Ac. N. Sci. Phila., V. 1862, p. 214, pl. XXXIII, fig. 283; Obs., IX, 1863, p. 36, pl. XXXIII, fig. 283.—CLESSIN, Conch. Cab. Ano., 1874, p. 153, pl. XLIX, figs. 3, 4.—SIMPSON, Syn., 1900, p. 647.

Margaron (Anodonta) kennicottii LEA, Syn., 1870, p. 78.

Anodonta simpsoniana LEA, Pr. Ac. N. Sci. Phila., V. 1861, p. 56; Jl. Ac. N. Sci. Phila., V, 1862, p. 212, pl. XXXII, fig. 281; Obs., IX, 1863, p. 34, pl. XXXII, fig. 281.—CLESSIN, Conch. Cab Ano., 1874, p. 119, pl. XXXVII, figs. 5, 6.

Margaron (Anodonta) simpsoniana LEA, Syn., 1870, p. 78.

Anodon simpsonianus SOWERBY, Conch, Icon., XVII, 1870, pl. XXXVII, fig. 153.

A form, which seems to be confined to the upper St. Lawrence and Arctic drainage. It is very variable, some specimens being evenly ovate, others long elliptical, and still others

subrhomboid. All, however, have the upcurved posterior ridge, the small but sharp beaks, and the dull, rough color, and the rest lines are usually, though not always, quite distinct. Lea has with his *A. dallasiana* a number of specimens that I believe are *A. kennicottii*, but a more careful comparison of his type of the former inclines me to believe that it is a near form of *pepiniana* and I have accordingly removed it to the synonymy of that species.

ANODONTA PEPINIANA Lea.

Shell rather small, distinctly rhomboid, subcompressed to subinflated, thin or moderately strong, inequilateral, with slightly elevated, sharp beaks, their sculpture very distinct, doubly-looped, subnodulous ridges; posterior ridge full, rounded, ending in a blunt point behind at the hinder base of the shell; growth lines uneven; epidermis dull, ashy or smoky-green, often quite pale and dark banded; nacre bluish-white, sometimes bright.

Length 55, height 32, diam. 18 mm.

Length 65, height 34, diam. 20 mm.

Upper and middle St. Lawrence; Lake Winnipeg.

Type locality, Lake Pepin, Portage Co., Ohio.

Anodonta pepinianus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 96, pl. XVI, fig. 51; Obs., II, 1838, p. 96, pl. XVI, fig. 51.

Anodon pepinianus SOWERBY, Conch. Icon., XVII, 1870, pl. XXXVI, fig. 150.

Anodonta pepiniana CLESSIN, Conch. Cab. Ano., 1874, p. 158, pl. LIII, figs. 1, 2.—SIMPSON, Syn., 1900, p. 647.

Margarita (Anodonta) pepiniana LEA, Syn., 1838, p. 30.

Margaron (Anodonta) pepiniana LEA, Syn., 1852, p. 49; 1870, p. 78.

Anodonta dallasiana LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 190; Jl. Ac. N. Sci. Phila., VI, 1866, p. 29, pl. XI, fig. 28: Obs., XI, 1863, p. 33, pl. XI, fig. 28.—CLESSIN, Conch. Cab. Ano., 1873, p. 107, pl. XXXIII, figs. 3, 4.

Margaron (Anodonta) dallasiana LEA, Syn., 1870, p. 78.

Anodonta kennicottii (part), SIMPSON, Syn., 1900, p. 647.

Is more distinctly rhomboid than *A. kennicottii,* the posterior ridge is more nearly straight, and it is generally smaller, but there are many intermediate specimens. It sometimes approaches the *Anodonta modesta* of Lea, but it is not so elongated or smooth as that species and the beak sculpture differs.

The following are indeterminate and spurious Anodontas:

Anodon anatinus SOWERBY, Rich. Faun. Bor. Am., III, 1836, p. 316.

Saskatchewan River; probably *A. implicata.*

Anodonta aureus PÆTEL, C. Sam., III, 1890, p. 176.

Anodonta brandti DROUET, Jl. de Conch., 1888, p. 108.

Anodonta callifera VON MARTENS, Proc. Zool. Soc., 1860, p. 15.

Anodon cochlearis SOWERBY, Conch. Icon., XVII, 1870, pl. XXXIII, fig. 135. Probably an *Anodontites.*

Anodonta chantrei BOURGUIGNAT, Jl. de Conch., 1883, p. 187.

Anodonta chinensis PÆTEL, C. Sam., III, 1890, p. 177.

Anodonta cornea PHILIPPI, Menke's Zeits., 1848, p. 130.

Anodonta curvatus JAY, Cat., 1850, p. 27.

Anodon dalei LESSON, Œuvres Buffon, I, p. 155, pl. III, fig. 1. ?

Anodonta dignota RAFINESQUE, Cont. Mon., 1831, p. 6.

Anodonta fragilis FITZINGER, Syst. Verz., 1833, p. 120.

Anodonta gallandi BOURGUIGNAT, Mat. Aceph. Eur., 1881, p. 95.

Anodonta hockingensis CALL, Am. Nat., 1880, p. 529, Moore, manuscript. According to Call, it is *A. grandis* Say.

Anodonta inflata RAFINESQUE, Cont. Monog., 1831, p. 6.

Anodonta laminata ROCHEBRUNE, Bull. Soc. Philom., VI, 1882, p. 40.

Anodonta lugubris SAY, N. Harm. Diss. II, 1829, p. 340.

Anodonta martensi CLESSIN, Conch. Cab. Ano., 1876, p. 181, pl. LXIII, fig. 2.

Anodonta ohioensis RAFINESQUE, An. Gen. Sci. Brux., V, 1820, p. 316.

Anodonta ovata STARK, Elements Nat. His., II, 1822, p. 90.

Anodon pictus SWAINSON, Ex. Conch., 2d ed., 1841, p. 39.

Anodonta polymorpha LEA, Syn., 1870, p. 84. Credited to Kuster. Where?

Anodontites radiata Valenciennes, Enc. Meth., 1824, p. 147, pl. CCIII, fig. 4 = *Modiolaria nigra*.

Anodonta recurvirostra Lea, Syn., 1870, p. 84; Kuster (?).

Anodonta rugifera Dunker, Mal. Bl., 1858, p. 225. Probably a *Spatha*.

Anodonta sedakowi Siecmaschiko, Bull. de Ac. Petersb., 1849, p. 225.

Anodonta somersi Call, Am. Nat., 1880, p. 529, credited to Moore, manuscript. *A. grandis* fide Call.

Anodon triangularis Sowerby, Conch. Icon., XVII, 1867, pl. XV, fig. 56.

Anodonta trigona Held, Isis., 1836, p. 280, *A. cygnea* probably. The name was used by Spix in 1827.

Anodonta truncata Kuster, Faun. Dalm., 1866, p. 131.

Anodonta tunizana Morelet, Jl. de Conch., 1864, p. 156.

Anodonta viridis H. and A. Adams, Gen. Rec. Moll., II, 1857, p. 503, as of Lea. Lea did not describe it.

Anodonta sulcosa H. and A. Adams, Gen. Rec. Moll., II, 1857, p. 503. Said to be of Conrad. Where?

Genus COLLETOPTERUM Bourguignat, 1881.

Colletopterum Bourguignat, Lettres Malacologiques, 1881, p. 45.

Shell inflated, thin; hinge arched; very short, without teeth, but with a feeble lateral lamella, shown in pronounced relief, winged in front and behind; ligament internal.

Animal unknown.

Type, *Anodonta letourneuxi* Bourguignat.

This group was established as a genus by Bourguignat to include a few thin-shelled, inflated, winged Naiades from the Danube. The hinge is said to have rudimentary laterals. Four species have been placed in it by its author and by Westerlund. I have seen no member of the genus.

Colletopterum letourneuxi Bourguignat.

Shell irregularly obovate, subcompressed, thin, with a low, angled anterior wing and a high, irregular dorsal one; beaks compressed, but elevated and sharp, with undulated sculpture;

surface with delicate growth lines; epidermis brilliant, of a clear yellow, reddish at the beaks and greenish at the post-dorsal region, with a few rays; nacre white, iridescent, hinge arched, short. There is a small lamella in one valve which fits into a groove in the other.

Length 55, height 42, diam. 15 mm.

Servia, at Belgrade.

Anodonta letourneuxi Bourguignat, Ann. Mal., I, 1870, p. 76.

Anodonta (Colletopterum) letourneuxi Westerlund, Faun. Pal., Pt. 7, 1890, p. 310.

Colletopterum letourneuxi Bourguignat, Mater. Moll. Aceph., I, 1881, p. 76.—Servain, Bull. Soc. Mal. Fr., VII, 1890, pl. VI, figs. 1, 2.—Simpson, Syn., 1900, p. 649.

Anodonta piscinalis letourneuxi Kobelt, Icon., new ed., XVIII, 1912, p. 47, pl. CCCCLXXI, figs. 2532-2534; pl. CCCCLXII, figs. 2535-2538.

Anodonta præclara Bourguignat, Ann. Mal., I, 1870, p. 78.

Anodonta (Colletopterum) præclara Westerlund, Faun. Pal., Pt. 7, 1890, p. 310.

Colletopterum præclarum Bourguignat, Mater. Moll. Aceph., I, 1881, p. 78.—Simpson, Syn., 1900, p. 649.

Anodonta eximia Bourguignat, Ann. Mal., I, 1870, p. 80.

Anodonta (Colletopterum) eximia Westerlund, Faun. Pal., Pt. 7, 1890, p. 310.

Colletopterum eximium Bourguignat, Mater. Moll. Aceph., I, 1881, p. 80.—Simpson, Syn., 1900, p. 649.

Anodonta tanousi Bourguignat, Ann. Mal., I, 1870.

Anodonta (Colletopterum) tanousi Westerlund, Faun. Pal., Pt. 7, 1890, p. 311.

Colletopterum tanousi Bourguignat, Mater. Moll. Aceph., I, 1881, p. 83.—Simpson, Syn., 1900, p. 649.

The descriptions of the hinge of this shell given by authors are rather vague and conflicting. According to Bourguignat the hinge is practically edentulous, there being a feeble lamina in one valve that fits into a socket in the other. It is quite likely that the species is only a peculiar *Anodonta* and possibly a form of *A. cygnea*.

Kobelt, (l. c.) unites all of Bourguignat's species under the name of *letourneuxi* and considers them to be only a variety of *Anodonta piscinalis*. He figures all four species from the original types.

Genus GABILLOTIA Servain, 1890.

Gabillotia Servain, Bull. Soc. Mal. Fr., VII, 1890, p. 296.

Shell large, subsolid, subcompressed, more or less rhomboid, gaping behind; beaks low, with fine, broken, concentric sculpture; epidermis shining; teeth rudimentary, one in each valve, sometimes rather sharp pointed and flattened; hinge with occasional vestiges of laterals; epidermal matter mingled with the nacre on the hinge; nacre brilliant, often finely radially ridged, especially at the pallial line.

Animal unknown.

Type, *Anodonta pseudodopsis* Locard.

Gabillotia pseudodopsis (Locard).

Shell large, almost evenly elliptical, thin but strong, subcompressed, most inflated in the middle and wedge-shaped from this point toward each end; beaks but slightly elevated, their sculpture consisting of numerous irregular, undulating bars; epidermis smooth, shining, grayish-yellow, brighter in the umbonal region, feebly, concentrically brown-banded, with three dark rays on the posterior slope; nacre bright, bluish-white.

Length 125-130, height 82-84, diam. 40-41.5 mm.

Syria.

Anodonta pseudodopsis Locard, Arch. Mus. Hist. Nat. Lyon, III, 1883, p. 255, pl. XIX bis., figs. 1-3.

Anodonta pseudodontopsis Crosse, Jl. de Conch., XXXI, 1883, p. 187.

Gabillotia pseudodopsis Servain, Bull. Soc. Mal. Fr., VII, 1890, p. 296, fig.—Simpson, Syn., 1900, p. 650.—Kobelt, Icon., new ed., XVIII, 1912, p. 33, pl. XDVI, fig. 2638.

A fine species, which differs from other members of the group in being almost exactly elliptical.

GABILLOTIA LOCARDI Servain.

"Shell obliquely rounded, subcompressed, thick, heavy, surface shining, sulcate with concentric striæ, fine except towards the edges; yellowish-brown, lighter on the umbonal region, which is a pale opaline-yellowish, and deepening on the postero-dorsal region to the color of a dead leaf, with much deeper colored rays radiating from the beaks to the posterior extremity; nacre bluish-white, beautifully iridescent. Valves gaping only behind the ligament, their convexity, though normal and regular, decidedly superior and extends almost to the center of the umbonal region (greatest convexity 42 mm. at 4 from the perpendicular, at 29 from the beaks, at 63 from the hinder end, at 48 from the anterior end, at 35 from the postero-dorsal angle and at 54 from the base of the perpendicular). Dorsal margin comparatively short, feebly curved as far as the postero-dorsal angle, thence sloping to the hinder end. Anterior region expanded, rounded and cut away below. Basal margin strongly curved. Posterior region short, scarcely one and one-half times as long as the anterior and narrowing almost abruptly to a low beak, very obtuse, rounded, though slightly truncate; beaks nearly central, only a little prominent, well rounded, feebly ridged, acute and very slight at their extremities. Dorsal groove very slight, marked by a deeper ray of color. Area slightly developed. Hinge edentulous, flat, covered anteriorly by the antero-interior ligament, and ending posteriorly at a short, hemisphærical lunule. Ligament short, very prominent and strong, chestnut-color.

Length 109, height 83, diam. 42 mm." (Servain.)

Asia Minor.

Gabillotia locardi SERVAIN, Bull. Soc. Mal. Fr., VII, 1890, p. 296, pl. v, figs. 1, 2.—SIMPSON, Syn., 1900, p. 650.—KOBELT, Icon., new ed., XVIII, 1912, p. 34, pl. XDVII, fig. 2639.

Kobelt (l. c.) considers this to be only an insignificant variation of the preceding species.

GABILLOTIA OPPERTI (Bourguignat).

Shell irregularly elliptical, being much more rounded on the dorsal than the ventral region, subsolid, subinflated, quite inequilateral; beaks low but sharp; anterior end subangular at

or below the median line; posterior ridge low, ending in a blunt, rounded point at the posterior base of the shell; ligament long; surface concentrically striate; epidermis dark horn-colored or brown; hinge strong, each valve having a well-developed, triangular, compressed tooth; nacre orange-tinted.

Length 120, height 80, diam. 40 mm.

Euphrates River.

Unio opperti Bourguignat, Rev. et Mag., VIII, 1856, p. 71, pls. VIII, fig. 6; IX, fig. 1.

Pseudodon opperti Westerlund, Faun. Pal., II, Pt. 7, 1890, p. 182.

Margaritana opperti Pætel, Conch. Sam., III, 1890, p. 173.

Gabillotia opperti Simpson, Syn., 1900, p. 650.

Pseudodontopsis opperti Kobelt, Icon., new ed., XIX, 1912, p. 6, pl. DXIV, fig. 2692.

Only a single valve of this fine species was obtained by Oppert, but there are two shells in the Lea collection that I refer to this species. It differs from *G. pseudodopsis* in having the whole dorsal outline much more strongly curved than that of the base, in fact the line of the hinder part of the base is straight.

Gabillotia euphratica (Bourguignat).

Shell subrhomboid, compressed, scarcely subsolid, inequilateral; beaks low, compressed; posterior ridge low, double, ending behind a little below the median line in a wide, faint biangulation; post-dorsal region elevated into a low wing, which is truncated behind; base rounded; anterior end narrowed, rounded and slightly cut away below; surface finely concentrically striate, shining, fuscous-green; hinge with a single imperfect, compressed, smooth tooth in each valve, that in the left under the beak, that in the right a little in front of it; muscle scars shallow; nacre white, tinted purple, silvery.

Length 70, height 53, diam. 20 mm.

Asiatic Turkey.

Unio euphraticus Bourguignat, Test. Nov., 1852, p. 28; Cat. Rais., 1853, p. 75, pl. IV, figs. 1-3.

Pseudodon euphratica CONRAD, Am. Jl. Conch., I, 1865, p. 233.
Margaritana euphratica VON MARTENS, Vorderas Conch., 1874, p. ?.—KOBELT, Icon., new ed., II, 1886, p. 26, pl. XLV, fig. 266.
Leguminaia euphratica WESTERLUND, Faun. Pal., II, Pt. 7, 1890, p. 188.
Gabillotia euphratica SIMPSON, Syn., 1900, p. 650.
Pseudodontopsis euphratica KOBELT, Icon., new ed., XIX, 1912, p. 2, pl. DXI, fig. 2687.
Unio churchillianus SOWERBY, Conch. Icon., XVI, 1868, pl. XCVI, fig. 526.
Pseudodontopsis babylonica KOBELT, Icon., new ed., XIX, 1912, p. 4, pl. DXII, figs. 2688, 2689.
Pseudodontopsis piestius KOBELT, Icon., new ed., XIX, 1912, p. 5, pl. DXIII, figs. 2690, 2691.

Var. *churchilliana* (Bourguignat).

More decidedly rhomboid than the type, the anterior end and central base being almost angularly produced.

Length 90, height 74, diam. 22 mm.

Asiatic Turkey.

Unio churchillianus BOURGUIGNAT, Rev. et Mag., 1857, p. 18, pl. II, figs. 1-4.
Pseudodon churchillianus WESTERLUND, Faun. Pal., II, Pt. 7, 1890, p. 183.
Gabillotia euphratica var. *churchillianus* SIMPSON, Syn., 1900, p. 650.
Pseudodontopsis churchilliana KOBELT, Icon., new ed., XIX, 1912, p. 1, pl. DXI, fig. 2686.
Monocondylæa rhomboidea LEA, Pr. Ac. N. Sci., Phila., III, 1859, p. 187; Jl. Ac. N. Sci., Phila., IV, 1860, p. 263, pl. XLII, fig. 143; Obs., VII, 1860, p. 81, pl. XLII, fig. 143.
Margaron (Monocondylæa) rhomboidea LEA, Syn., 1870, p. 72.
Microcondylæa rhomboidea PÆTEL, Conch. Sam., III, 1890, p. 175.

Leguminaia rhomboidea KOBELT, Icon., new ed., VI, 1893, p. 94, pl. CLXXVIII, figs. 1124, 1125.

Unio rhomboideus SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXIX, fig. 480.

Pseudodon rhomboideus WESTERLUND, Faun. Pal., II, pl. VII, 1890, p. 183.

Lea's *Monocondylæa rhomboidea* is represented in his collection by a couple of opposed, matched valves, which seem to be identical with the *Unio churchillianus* of Bourguignat. One of these is more decidedly rhomboid and angular than the other. The species is shorter and much more rhomboid than *G. opperti* or *G. pseudodopsis.*

Kobert, (l. c. p. 3), has proposed a new genus for the species of *Gabillotia* from Asia Minor under the name of *Pseudodontopsis,* with this species as the type.

Genus LEGUMINAIA Conrad, 1865.

Leguminaia CONRAD, Am. Jl. Conch., I, 1865, p. 233.

Microcondylæa VEST, Vehr. Mitth. Sieben. Ver. Nat., 1866, p. 201.

Microcondylus DROUET, Jl. de Conch., 1879, p. 138.

Shell rhomboid-elliptical, slightly biangulate behind; posterior ridge faint and double; beaks anterior, sculptured with fine, concentric ridges, which are sometimes slightly corrugated, but which show a tendency to form two rounded loops; surface smooth or with very faint corrugations on the posterior slope; epidermis rayless or nearly so; a single tooth in each valve, that in the left under the beak, that in the right in front of it, teeth smooth; epidermal and ligamentary matter mingled with the nacre along the hinge; the two front anterior muscle scars united, the hinder distinct, posterior scars faint; beak cavities shallow; dorsal scars few, irregularly disposed.

Animal with the outer branchiæ adherent to the mantle throughout their entire length; inner free from the abdominal sac. (Drouet.)

Type, *Monocondylæa mardinensis* Lea.

The genus *Leguminaia* contains a few species of southeast Europe and Asia Minor that seem to be tolerably closely related, being generally oblong, of moderate solidity and inflation with a single smooth tooth in each valve. The laterals are vestigial or wanting. The group seems to be rather closely related to *Gabillotia,* but differs remarkably in the form of the shell. The shells of *Gabillotia* gape decidedly, while those of *Leguminaia* do not and the teeth are higher, more triangular and compressed.

KEY TO SPECIES OF LEGUMINAIA.

Shell rayed.	*L. michonii.*
Shell rayless.	
Elongated.	
Compressed, epidermis yellow.	*L. wheatleyi.*
Epidermis brownish. Shell thin.	*L. uniopsis.*
Convex, brownish, with strong teeth.	*L. mardinensis.*
Teeth feeble.	*L. tripolitana.*
Epidermis blackish.	*L. saulcyi.*
Thin, strongly sulcate.	*L. michonii.*
Short elliptical or rhomboid.	*L. locardi.*

Section LEGUMINAIA S. S.

Shell somewhat solid, elliptical to rhomboid; beaks rather full; teeth strong, with sometimes a slight secondary tooth in the left valve, well in front.

Group of *Leguminaia mardinensis.*

Characters as in the subgenus.

LEGUMINAIA MARDINENSIS (Lea).

Shell oblong, somewhat rhomboid, inequilateral, subsolid, convex; beaks slightly elevated but not inflated, rather sharp, their sculpture consisting of fine, broken, more or less doubly looped ridges; posterior ridge low, ending behind in a wide, rounded point near the base of the shell; basal line incurved;

surface with irregular growth lines; epidermis dull, ashy brown, reddish-brown or yellowish-green; left valve with a compressed, smooth, triangular tooth just behind the beak and a rudimentary one in front of it; right valve with a single tooth in front of the beak; laterals wanting; dorsal scars deep, irregular; nacre whitish or flesh-colored, often granulous in the cavity and radially striated on the border.

Length 90, height 45, diam. 30 mm.

Length 63, height 37, diam. 22 mm.

Southern Turkey in Asia.

Monocondylæa mardinensis LEA, Pr. Ac. N. Sci., Phila., VIII, 1864, p. 286; Jl. Ac. N. Sci., Phila., VI, 1869, p. 252, pl. XXX, fig. 67; Obs., XII, 1869, p. 12, pl. XXX, fig. 67.

Leguminaia mardinensis CONRAD, Am. Jl. Conch., I, 1865, p. 233.—KOBELT, Icon., new ed., VI, 1893, p. 92, pl. CLXXVII, figs. 1122, 1123.—SIMPSON, Syn., 1900, p. 651.

Margaron (Monocondylæa) mardinensis LEA, Syn., 1870, p. 73.

Margaritana mardinensis CLESSIN, Conch. Cab. Ano., 1876, p. 266, pl. LXXXIII, figs. 1, 2.

Leguminaia (mardinensis var.*) naegelei* KOBELT, Icon., new ed., XIX, 1912, p. 7, pl. DXV, fig. 2693.

Var. *chantrei* Locard.

The beaks are a little fuller, the shell is perhaps a little more inflated than the type, and, according to Locard, the teeth are not so well developed.

Canal of Orontes and Lake Antioch.

Leguminaia chantrei LOCARD, Arch. Mus. Lyon, III, 1883, p. 252, pl. XIX bis, figs. 8-10.—KOBELT, Icon., 1st sup., 1895, p. 23, pl. IV, fig. 3.

Leguminaia mardinensis var. *chantrei* SIMPSON, Syn., 1900, p. 651.

Monocondylæa chantreyi PÆTEL, Conch. Sam., III, 1890, p. 174.

Leguminaia bourguignati LOCARD, Arch. Mus. Lyon, III, 1883, p. 252, pl. XIX bis, figs. 11-18.

Leguminaia (?) bourguignati KOBELT, Icon., new ed., XIX, 1912, p. 9, pl. DXVI, fig. 2695.

LEGUMINAIA TRIPOLITANA (Bourguignat).

Shell long elliptical, convex, rather solid, inequilateral, with scarcely elevated or inflated, sharp beaks; posterior ridge low, somewhat double, ending behind at and below the median line in a wide, feeble biangulation; surface lightly, concentrically sculptured, fuscous-green; hinge with a single small, thin tooth in each valve, and a vestige of a lateral.

Length 70, height 53, diam. 20 mm.

Tripoli, Syria.

Unio tripolitanus BOURGUIGNAT, Test. Nov., 1852, p. 28; Cat. Rais., 1853, p. 75, pl. IV, figs. 10-12.

Pseudodon tripolitanus CONRAD, Am. Jl. Conch., I, 1865, p. 233.

Margaritana tripolitana CLESSIN, Conch. Cab. Ano., 1876, p. 265, pl. LXXXV, figs. 6, 7.

Leguminaia tripolitana WESTERLUND, Faun. Pal., II, Pt. 7, 1890, p. 190.—SIMPSON, Syn., 1900, p. 652.

Probably only a variety of *L. mardinensis*. It is more evenly long elliptical than that species, being slightly rounded on the base instead of arcuate. According to its author it has slight lateral teeth. It seems to stand partly between *mardinensis* and *wheatleyi*, being less inflated than the former and slightly more so than the latter.

LEGUMINAIA WHEATLEYI (Lea).

Shell oblong, somewhat rhomboid, subcompressed, subsolid, inequilateral; beaks but little elevated or swollen, sharp and turned forward over a narrow lunule, their sculpture very faint, somewhat doubly-looped ridges; posterior ridge low and rounded, ending bluntly behind below the median line; surface with numerous growth lines, often with one or more slight, radial ridges or furrows on the posterior slope; epidermis pale

tawny with dark, concentric bands; there is a single irregular, nearly smooth tooth in each valve, that of the left under the beak, the one in the right a little in front of it, and there are sometimes feeble traces of laterals; muscle scars shallow; nacre brilliant, silvery or bluish-white.

Length 66, height 36, diam. 20 mm.

Southern Turkey in Asia.

Monocondylæa wheatleyi LEA, Pr. Ac. N. Sci., Phila., VI, 1862, p. 176; Jl. Ac. N. Sci., Phila., V, 1863, p. 400, pl. L, fig. 307; Obs., X, 1863, p. 34, pl. L, fig. 307.

Pseudodon wheatleyi CONRAD, Am. Jl. Conch., I, 1865, p. 233.

Margaron (Monocondylæa) wheatleyi LEA, Syn., 1870, p. 72.

Microcondylæa (Margaritana) wheatleyi CLESSIN, Conch. Cab. Ano., 1875, p. 259, pl. LXXXI, figs. 1, 2.

Microcondylæa wheatleyi PETEL, Conch. Sam., III, 1890, p. 175.

Leguminaia wheatleyi LOCARD, Arch. Mus. Lyon, III, 1883, p. 276.—SIMPSON, Syn., 1900, p. 652.—KOBELT, Icon., new ed., XIX, 1912, p. 16, pl. DXX, fig. 2704.

Leguminaia wheatleyi var. *euphratica* KOBELT, Icon., new ed., XIX, 1912, p. 17, pl. DXX, fig. 2705.

A more delicate species than *L. mardinensis*. It is more compressed, not quite so solid, and the epidermis is paler.

LEGUMINAIA SAULCYI (Bourguignat).

Shell oblong, slightly wider and nearly evenly rounded behind, rounded in front, inequilateral; beaks rather full; surface decidedly concentrically sculptured; epidermis blackish; hinge with a small tooth in each valve; laterals wanting.

Syria.

Unio saulcyi BOURGUIGNAT, Test. Noviss., 1852, p. 27; Cat. Rais., 1853, p. 74, pl. III, figs. 1-3.

Pseudodon saulcyi CONRAD, Am. Jl. Conch., I, 1865, p. 233.

Margaron (Monocondylæa) saulcyi LEA, Syn., 1870, p. 72.

Microcondylæa saulcyi CLESSIN, Conch. Cab. Ano., 1876, p. 260, pl. LXXXVI, figs. 4, 5.

Leguminaia saulcyi SIMPSON, Syn., 1900, p. 652.

This species is almost evenly rounded at both ends, the hinder being a very little wider. It is apparently a good deal thinner and more sulcate than *mardinensis, tripolitana* or *wheatleyi* and differs from all of the species in being almost black.

LEGUMINAIA MICHONII (Bourguignat).

Shell elliptical, convex, thin, inequilateral; beaks scarcely full or elevated, with wrinkled sculpture; surface concentrically sculptured; epidermis green, with darker green rays; hinge with a single compressed, smooth tooth in each valve, that in the left under the beak, that of the right in front of it; laterals wanting.

Length 30, height 35, diam. 15 to 17 mm.

Jaffa, Syria.

Unio michonii BOURGUIGNAT, Test. Nov., 1852, p. 27; Cat. Rais., 1853, p. 74, pl. III, figs. 10-12.

Pseudodon michonii CONRAD, Am. Jl. Conch., I, 1865, p. 233.

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

Leguminaia michonii WESTERLUND, Faun. Pal., II, Pt. 7, 1890, p. 190.—SIMPSON, Syn., 1900, p. 652.

This species has much the same form as *L. saulcyi*, being almost evenly rounded before and behind, but it is not so long in proportion to its height, is apparently thinner and is rayed.

Section PSEUDOLEGUMINAIA Germain, 1911.

Pseudoleguminaia GERMAIN, Bull. Mus. Hist. Nat., 1911, p. 66.

Shell nearly evenly elliptical, somewhat inflated, rather thin, subtransparent; beaks near the center, rather full, curved forward, with irregular undulations; epidermis bright yellowish-brown; nacre brilliant; pseudocardinals very obtuse, rather prominent and thick.

Type, *Pseudodon chantrei* Locard.

LEGUMINAIA LOCARDI Simpson.

Shell elliptic rhomboid, being very slightly truncated on the posterior slope, almost equilateral, convex, rather thin, and subtransparent; beaks full and slightly elevated, turned for-

ward, sculptured with undulating, somewhat doubly-looped ridges; surface concentrically sculptured; epidermis brilliant, brownish-yellow at the border, lighter and grayish at the beaks; hinge with a single obtuse, elongated tooth in each valve; nacre smooth, brilliant, bluish-white.

Length 63, height 43, diam. 24 mm.

Lake Antioch, Syria.

Pseudodon chantrei LOCARD, Arch. Mus. Lyon, III, 1883, p. 254, pl. XIX bis, figs. 4-7.

Leguminaia locardi SIMPSON, Syn., 1900, p. 653.

I have never seen this shell, but its semi-transparent texture, its short, nearly evenly elliptical form, and the beaks, which are placed nearly in the center, will distinguish it from all others.

Section MICROCONDYLÆA Vest, 1866.

Microcondylæa VEST, Verh. Mitth. Sieben. Ver. Nat., 1866, p. 201.

Shell inequilateral, elongate, subrhomboid or elliptical, compressed, rather thin, with low beaks; teeth rudimentary, much compressed, a single one in each valve; nacre bluish or purplish-white.

Animal, as in typical *Leguminaia*.

Type, *Anodonta uniopsis* Lamarck.

LEGUMINAIA UNIOPSIS (Lamarck).

Shell oblong, subelliptical, obovate or subrhomboid, more or less compressed, scarcely subsolid, quite inequilateral; beaks low, their sculpture a number of delicate ridges running nearly parallel with the dorsal line, though sometimes slightly doubly looped; posterior ridge low, often faintly double, ending behind at or below the median line in a feeble biangulation; anterior end narrowed, often a little angular above; surface unevenly, but delicately, sculptured with concentric growth lines, ashy-green in front, green behind, or brownish, sometimes nearly black; there is generally a single low, subcompressed, rounded tubercle in each valve, though it is some-

times wanting; laterals scarcely ever developed; muscle scars shallow; nacre bluish-white, rather dull.

Length, 57, height 28, diam. 13 mm.

Length 68, height 33, diam. 14 mm.

Length 74, height 33, diam. 20 mm.

South central and southeastern Europe.

Anodonta uniopsis LAMARCK, An. sans Vert., VI, 1819, p. 86. —DESHAYES, Tr. Element., II, 1853, p. 218, pl. XXX, fig. 4.

Margarita (Anodonta) uniopsis LEA, Syn., 1836, p. 50; 1838, p. 30.

Anodon uniopsis CATLOW and REEVE, Conch. Nom., 1845, p. 68.

Margaron (Anodonta) uniopsis LEA, Syn., 1852, p. 49; 1870, p. 78.

Leguminaia uniopsis SIMPSON, Syn., 1890, p. 653.

Unio depressa C. PFEIFFER, Nat. Deuts. Moll., 1825, Pt. 2, p. 32, pl. VIII, figs. 3, 4.

Leguminaia depressa WESTERLUND, Faun. Pal., II, Pt. 7, 1890, p. 191.

Alasmodonta compressa MENKE, Syn., 1828, p. 106.—STABILE, Faun. Lug., 1845, p. 60, pl. III, fig. 71.

Unio bonelli ROSSMASSLER, Icon., II, 1835, p. 24, pl. IX, fig. 134.—HANLEY, Biv. Shells, 1843, p. 212, pl. XXIII, fig. 59. —SOWERBY, Conch. Icon., XVI, 1868, pl. LXXIX, fig. 414.

Margarita (Margaritana) bonellii LEA, Syn., 1836, p. 45; 1838, p. 27.

Margaritana bonellii KUSTER, Conch. Cab. Unio, 1862, p. 296, pl. XCIX, fig. 1.—KOBELT, Icon., 1884, p. 62, pl. XXV, figs. 208, 209; XXVI, fig. 210.

Margaron (Margaritana) bonellii LEA, Syn., 1852, p. 43; 1870, p. 72.

Baphia bonellii H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 498.

Anodon bonelli SOWERBY, Conch. Icon., XVII, 1867, pl. XI, fig. 34.

Microcondylæa bonellii CLESSIN, Conch. Cab. Ano., 1861, p. 257; Moll. Osterr., 1887, p. 719, figs. 486, 487.

Microcondylus bonelli DROUET, Jl. de Conch., XXVI, 1879, p. 138.

Margaritana (Microcondylæa) bonellii KOBELT, Icon., 1884, p. 62, pl. XXV, figs. 208, 209.

Leguminaia bonellii WESTERLUND, Faun. Pal., II, Pt. 7, 1890, p. 191.

Lamarck's brief description of *Anodonta uniopsis* entirely agrees with the shell commonly known as *Microcondylæa* or *Monocondylæa bonellii*. The statement that the ligament passes into the hinge exactly fits this, and this is one of the best generic characters of *Leguminaia*.

The amount of variation of this species is very great. In many cases the posterior end has evidently been injured by unfavorable environment, and the shell is dwarfed and variously distorted, and sometimes a good deal thickened. Of course every individual variation and distortion of this kind has been seized on by the New School and elevated to specific rank. I have seen only what seemed to me a single species of this subgenus, and nothing which really was worthy of a varietal name

Indeterminate species.

Leguminaia nisibana KOBELT, Icon., new ed., XIX, 1912, p. 17, pl. DXX, fig. 2706.

Nisibis, Wilajet Diarbekir.

Described from a single left valve.

Genus LASTENA Rafinesque, 1820.

Lastena RAFINESQUE, Ann. Gen. Sci. Phys. Brux., 1820, p. 316. —ORTMANN, Ann. Car. Mus., VIII, 1912, p. 297.

Odatelia RAFINESQUE, Atlantic Jl. and Friend, 1832, p. 154.

Leptodea (Rafinesque) CONRAD, Pr. Ac. N. Sci. Phila., 1853, p. 262.

Shell elongated, subsolid, inequilateral, generally wider in front, rounded-truncate at anterior base, pointed at post-basal region, and having a low posterior ridge, with one or more secondary ridges above it; beaks low, sculpture consisting of

a few coarse, irregular, longitudinal folds; epidermis shining, often rayed; a single imperfect tooth occurs in each valve, and sometimes vestiges of laterals; there is one roughened dorsal scar in the shallow beak cavity; muscle scars very large, deep and distinct, the posterior greatly elongated; nacre purplish, shading to blue at the edge; pallial line radially ridged.

Animal with very long branchiæ, inner and outer about alike in size and form, projecting free slightly behind, the inner free from the abdominal sac nearly the whole length, brownish throughout; palpi long, large; mantle thickened at edge, brown, black above; branchial opening large, with heavy papillæ; anal opening large, without papillæ; superanal opening united below; foot very large when living, club-shaped, capable of great extension. No gravid specimens have been seen, but the outer branchiæ are probably used as a marsupium.

Type, *Lastena lata* Rafinesque.

LASTENA LATA Rafinesque.

Shell elongated, subrhomboid, subsolid, compressed, inequilateral; beaks low and compressed but pointed, sculptured with a few strong ridges, which run nearly parallel with the dorsal margin; posterior ridge low, but often angled, usually ending behind in a point near the base of the shell, but sometimes the hinder part of the shell is much attenuated; above the posterior ridge there is generally a radial shallow furrow; surface with uneven growth lines, sometimes nearly smooth in front of the post-ridge; epidermis brownish-green, smoky, commonly having scattered, wide and narrow, broken rays; hinge often edentulous, sometimes with a feeble, smooth, compressed tooth or ridge; muscle scars confluent, the posterior ones elongated; nacre pale blue or purplish, the cavities darker; pallial line showing a small, posterior sinus.

Length 88, height 30, diam. 16 mm.

Length 75, height 30, diam. 16 mm.

Ohio, Cumberland, and Tennessee River systems.

Type locality, Kentucky River.

Anodonta (Lastena) lata RAFINESQUE, Ann. Gen. Sci. Phys. Brux., V, 1820, p. 317, pl. LXXXII, figs. 17, 18.

Anodonta lata FERUSSAC, Guer. Mag., 1835, p. 25.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 26, pl. III, figs. 17, 18.

Leptodea lata CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 262.

Anodon lata SOWERBY, Conch. Icon., XVII, 1867, pl. XIX, fig. 76.

Lastena lata SIMPSON, Syn., 1900, p. 654.

Unio latus CONRAD, New F. W. Shells, 1834, p. 70.—KUSTER, Conch. Cab. Unio, 1861, p. 388, pl. LXVII, fig. 5.

Unio dehiscens SAY, N. Harm. Diss., II, 1829, p. 308; Am. Conch., III, 1830, pl. XXIV.—HANLEY, Biv. Shells, 1843, p. 204, pl. XXI, fig. 36.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 32, pl. IX, figs. 7-9.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXV, fig. 393.

Margarita (Unio) dehiscens LEA, Syn., 1836, p. 35; 1838, p. 23.

Hemilastena dehiscens AGASSIZ, Arch. für Nat., I, 1852, p. 50.

Margaron (Margaritana) dehiscens LEA, Syn., 1852, p. 43; 1870, p. 69.

Baphia dehiscens H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 499.

Margaritana dehiscens CLESSIN, Conch. Cab. Ano., 1873, p. 274, pl. XXIV, figs. 3, 4.

Anodonta dehiscens PÆTEL, Conch., Sam., III, 1890, p. 178.

Odatelia radiata RAFINESQUE, Atlantic Jl. and Friend., 1832, p. 154.

Unio oriens LEA, Tr. Am. Phil. Soc., IV, 1834, p. 73, pl. VI, fig. 5; Obs., I, 1834, p. 83, pl. VI, fig. 5.—CHENU, Ill. Conch., 1858, pl. XIV, figs. 2, *2a*, *2b*.—KUSTER, Conch. Cab., 1861, p. 222, pl. LXXV, fig. 2.—SOWERBY, Conch. Icon., XVI, 1868. pl. LXIII, fig. 314.

Unio hildrethi DELESSERT, Rec. Coq. Lam., 1841, pl. XIX, figs. *4a*, *4b*.

The shell gapes decidedly in front and behind and is generally a little twisted or uneven along the line of junction of the valves. The form varies a good deal, perhaps on account of the fact that the species burrows. Many of the shells are

highest in front, being often cut away at the anterior base, and gradually tapering to the extreme posterior end. In other cases the shell is long rhomboid, and it is sometimes widest toward the posterior end. This species does not seem to show any close relationship with any living form. The character of the posterior sinus of the pallial line is like that of *Solenaia,* the greatly lengthened foot and burrowing habit are characters in common with that genus, but it is doubtful whether they indicate any close relationship. They are probably the result of similar environment.

Genus SOLENAIA Conrad, 1869.

Solenaia Conrad, Am. Jl. Conch., IV, 1869, p. 249.

Shell greatly elongated, falcate, rather thin, narrower and rounded in front, the upper anterior portion being strongly sulcate, gaping at anterior base and behind, having a strong posterior ridge that ends in a point at the post-base; beaks low; sculpture of slightly double-looped, concentric ridges; epidermis rayless; hinge line narrow; teeth rudimentary, being mere vestiges of one or more lamellar laterals in each valve; dorsal scars numerous, in a line under the hinge; anterior scars faint; posterior elongated; pallial line with a distinct posterior sinus.

According to Fischer the foot is enormously developed for the purpose of burrowing, as in *Mycetopoda.* It is probable that the mantle is closed behind into two siphons.

Type, *Mycetopus emarginatus* Lea.

The genus *Solenaia* was established by Conrad for the *Mycetopus emarginatus* of Lea, which Conrad believed was erroneously placed in d'Orbigny's genus. He states that the species, which he takes as the type of his genus, has lateral teeth and that it differs also from *Mycetopus* in having the anterior end reflexed and simple anterior muscular scars. In the Journal de Conchyliologie in 1890, Dr. Paul Fischer in a paper on *Mycetopus* states that Pere Heude had examined the animal of Chinese species of this group and ascertained that it had a foot developed to an extraordinary length and that it

burrowed in the mud. As *Mycetopoda* has a similar foot and habit, the great savant concluded that the Asiatic and South American forms were closely related and placed all of them in d'Orbigny's genus *Mycetopus*.

Nearly all the shells I have seen of the Asiatic group have feeble, elongated lateral teeth and this fact was so apparent to Dr. Lea that he placed the *Anodonta soleniformis* of Benson in the genus *Unio*. Sometimes there are vestiges of pseudocardinals in these forms as well as of laterals. The true Mycetopodas are edentulous, or in some cases, when examined with a glass under a good light, they show traces of a row of denticles such as are exhibited by many members of the family *Mutelidæ*. The animal of the South American forms is mutelid. I know nothing of that of *Solenaia* beyond the statement of Fischer regarding its greatly developed, mushroom shaped foot and its burrowing habit. It is, I am satisfied, an unionoid animal and the fact that there is a decided posterior pallial sinus to the shell leads me to believe that it has two siphons.

The shell of *Solenaia* is of duller texture than that of *Mycetopoda*, it is not so smooth and shining; wherever the beaks have been preserved they are sculptured, whereas those of *Mycetopoda* are smooth.

Key to species of Solenaia.

Anterior end much produced and drawn out at the anterior base.

Shell almost squarely truncate behind. *S. emarginata.*

Obliquely truncated behind, pointed below. *S. falcata.*

Anterior end scarcely or not at all produced.

Shell much elongated.

Laterals partly developed, posterior slope having a furrow. *S. soleniformis.*

Laterals scarcely developed, epidermis light colored. *S. oleivora.*

Posterior ridge high, epidermis dark. *S. iridinea.*

Shell moderately elongated.

Much wider behind. *S. rivularis.*

Not greatly widened behind, beaks high and full. *S. rugata.*

Shell short, with low, sharp beaks. *S. triangularis.*

Group of *Solenaia emarginata.*

Anterior region much narrowed, drawn out in the direction of the anterior base, marked off from the rest of the shell by a faint ridge.

SOLENAIA EMARGINATA (Lea).

Shell greatly elongated, inequilateral, thin, gaping behind, somewhat compressed, narrow in front, the anterior end being drawn downward and forward into a rounded lobe; from this point the shell gradually and regularly becomes wider to the extreme posterior end; there is an anterior ridge separating the front lobe from the rest of the shell; posterior ridge subangular, ending behind at the base of the shell, posterior end subtruncate; beaks low and compressed, but sharp, with doubly-looped, subnodulous sculpture; surface having decided concentric sculpture throughout, with a radial sulcus on the posterior slope; epidermis pale, ashy-green; nacre bluish-white, semitransparent and showing the outside sculpture; hinge with vestigial laterals and pseudocardinals.

Length 125, height 34, diam. 16 mm.

Siam.

Mycetopus emarginatus LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 308; Jl. Ac. N. Sci. Phila., V, 1863, p. 398, pl. L, fig. 305; Obs., X, 1863, p. 34, pl. L, fig. 305.—SOWERBY, Conch. Icon., XVI, 1868, pl. II, fig. 6.—FISCHER, Jl. de Conch., XXXVIII, 1890, p. 11.

Platiris (Mycetopus) emarginatus LEA, Syn., 1870, p. 90.

Anodonta emarginatus CLESSIN, Conch. Cab. Ano., 1875, p. 169, pl. LV, figs. 5, 6.

Mycetopus (Solenaia) emarginatus FISCHER, Bull. Soc. d'Autun, IV, 1891, p. 135.

Solenaia emarginata CONRAD, Am. Jl. Conch., IV, 1869, p. 249. —SIMPSON, Syn., 1900, p. 655.

The type, the only shell I have seen, is badly broken and apparently somewhat warped. It probably gapes at the pos-

terior end. The beaks are somewhat eroded but they display the doubly-looped sculpture quite distinctly, proving that the species is in no way related to *Mycetopoda*.

SOLENAIA FALCATA (Higgins).

Shell greatly elongated, very thin, inequilateral, subcompressed, the anterior end drawn downward and forward into a long, rounded point; from the anterior end the shell gradually and regularly widens to the posterior end; posterior ridge angulated, ending behind in a point at the base of the shell; beaks low, their sculpture not seen; surface with fine, uneven growth lines, somewhat sulcate on the post-dorsal slope, and strongly sulcated in front of the decided anterior ridge, with a low, faint, radial depression above the posterior ridge; epidermis pale ashy-green with reddish tint on the central area; there seems to be a vestige of a lateral in each valve, and a faint hint at a tooth near the beaks; nacre lurid whitish, tinged dull purple.

Length 93, height 19.5, diam. 10.5 mm.

Southeastern Asia?

Mycetopus falcatus HIGGINS, Proc. Zool. Soc. Lond., 1868, p. 179, pl. XIV, fig. 6.—SOWERBY, Conch. Icon., XVI, 1868, pl. IV, fig. 9.—CLESSIN, Conch. Cab. Ano., 1875, p. 204, pl. LXVII, figs. 1, 2.

Platiris (Mycetopus) falcatus LEA, Syn., 1870, p. 90.

Solenaia falcata SIMPSON, Syn., 1900, p. 656.

This shell is almost a perfect miniature of *S. emarginata*. It differs in being slightly more drawn out in proportion at the anterior end, in being smoother and reddish on the central area. It is a little more obliquely truncated behind perhaps than *emarginata*, and the nacre is duller and more inclined to be purple. I cannot be positive, but I am inclined to believe that the shell has vestigial pseudocardinals and laterals. Its texture and form would indicate that it was a *Solenaia* and not a *Mycetopoda*, and I cannot help but believe that the locality, forest streams near Chyavetas, upper Amazon, where it was said to be discovered by Mr. Bartlett, is an error and that it is

a species of Southeastern Asia. It was described with a miscellaneous lot of shells from various places and has probably been credited to the wrong region.

Group of *Solenaia soleniformis*.

Shell only slightly narrowed in front, the narrow area not distinctly marked off from the rest of the shell.

SOLENAIA SOLENIFORMIS (Benson).

Shell elongated, rather solid, narrower and rounded in front, subcompressed, inequilateral; gaping at the anterior base; beaks rather full; posterior ridge low, ending behind in a point at the base of the shell; surface with uneven, concentric sculpture, the median area nearly smooth; epidermis green to blackish; above the posterior ridge there is a shallow, radial furrow; posterior end obliquely truncated; hinge with vestiges of pseudocardinals; left valve with two faint laterals; right valve with one; nacre dirty purplish.

Length 160, height 42, diam. 18 mm.

Assam, India.

Anodonta soleniformis BENSON, Jl. As. Soc. Bengal, V, 1836, p. 749.

Spatha soleniformis HANLEY and THEOBALD, Conch. Ind., 1876, p. 5, pl. IX, fig. 1.

Mycetopus soleniformis FISCHER, Jl. de Conch., XXXVIII. 1890, p. 94.

Solenaia soleniformis SIMPSON, Syn., 1900, p. 656.

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

Mycetopus bensonianus PÆTEL, Conch. Sam., III, 1890, p. 186.

This species has vestigial teeth so well developed that Lea placed it in the genus *Unio*. It differs from *oleivora*, to which it is nearly allied, in having a feeble, radial groove on the dorsal slope, and in not having the anterior area distinctly marked out. There is a posterior sinus marked quite distinctly.

SOLENAIA OLEIVORA (Heude).

Shell much elongated, narrower in front, inequilateral, subcompressed, gaping all along the front half of the base and behind, beaks low; posterior ridge elevated and angular, end-

ing behind in a point at the base of the shell; there is a faint anterior ridge, which runs in the direction of the anterior base; posterior end obliquely truncated; surface unevenly sulcate, the anterior end very strongly, concentrically ridged back to the anterior ridge and forming a sort of area; epidermis greenish-yellow, shining; hinge with only the faintest vestiges of teeth; nacre bluish-white with a slight pallial sinus marked on it posteriorly; anterior scars irregular; posterior scars large.

Length 177, height 45, diam. 25 mm.

China.

Mycetopus oleivorus HEUDE, Conch. Fluv, Nank., III, 1877, pl. XXII, fig. 46; XXIII, fig. 48.

Solenaia oleivora SIMPSON, Syn., 1900, p. 656.

Mycetopus recognitus HEUDE, Conch. Fluv. Nank., III, 1877, pl. XXII, fig. 47.

Mycetopus cæruleus HEUDE, Conch. Fluv. Nank., IX, 1885, pl. LXXI, fig. 135.

Mycetopus armatus HEUDE, Conch. Fluv. Nank., IX, 1885, pl. LXX, fig. 133.

Mycetopus arcuatus FISCHER, Jl. de Conch., XXXVIII, 1890, p. 11.

Mycetopus viridis HEUDE, Conch. Fluv. Nank., IX, 1885, pl. LXXI, fig. 136.

Mycetopus succineus HEUDE, Conch. Fluv. Nank., IX, 1885, pl. LXX, fig. 134.

The posterior ridge is a little sharper than in *soleniformis*, the nacre is lighter colored, and the beaks are placed a little farther away from the anterior end.

SOLENAIA IRIDINEA (Heude).

Shell much elongated, arcuate, narrower in front, scarcely subsolid, subcompressed, gaping below and behind; anterior end rounded; scarcely marked off from the rest of the shell; beaks low, placed well forward; posterior ridge high and angled, curved upward in the middle, ending behind in a point at the base of the shell; posterior end truncated; surface somewhat irregularly concentrically sculptured, epidermis thick,

black, scarcely shining; hinge with a low ridge in each valve in place of laterals; pseudocardinals wanting; nacre bluish-white, dirty, having a posterior sinus distinctly marked out.

Length 127, height 34, diam. 18 mm.

China.

Mycetopus iridineus HEUDE, Jl. de Conch., XXII, 1874, p. 117; Conch. Fluv. Nank., I, 1875, pl. VIII, fig. 19.

Solenaia iridinea SIMPSON, Syn., 1900, p. 657.

Mycetopus similis HEUDE, Conch. Fluv. Nank., III, 1877, pl. XXIII, fig. 50.

A smaller species than *S. oleivora,* rather more arcuate, narrower proportionally in front and having much darker epidermis. It is smaller than *soleniformis,* has a more decided and angled posterior ridge, has no radiating sulcus on the posterior slope and the nacre is differently colored.

SOLENAIA RIVULARIS (Heude).

Shell somewhat elongated, very much widened behind, inequilateral, very slightly arcuate, compressed; posterior ridge rather sharply angled; beaks apparently low and placed at a considerable distance from the anterior end; posterior end subtruncate, the truncation below meeting the base line at an acute angle; on the posterior slope there is a slight, radial ridge; surface apparently slightly sulcate, the anterior end having stronger sculpture; epidermis olivaceous; nacre rose, spotted.

Length 65, height 28, diam. 20 mm.

China.

Mycetopus rivularis HEUDE, Conch. Fluv. Nank., III, 1877, pl. XXIII, fig. 49.

Solenaia rivularis SIMPSON, Syn., 1900, p. 657.

The dorsal and ventral lines are very slightly curved so that the shell is a trifle arcuate. The posterior end is very much widened; it is subtruncate and faintly biangulate behind. It is shorter in proportion than *soleniformis* or *oleivora.*

SOLENAIA RUGATA (Sowerby).

Shell elongated, gradually widened behind, dorsal and ventral lines curved a little so that the shell is a trifle arcuate; inequilateral; beaks high and full; there is an anterior and posterior ridge, the latter curved up in the middle, angular and ending behind in a blunt point at the base of the shell; posterior end truncated obliquely; surface irregularly, concentrically sculptured; epidermis olive-brown.

Length 92, height 31 mm.

Said to come from Victoria River, Australia. I am a little in doubt about the locality.

Mycetopus rugatus SOWERBY, Conch. Icon., XVI, 1868, pl. III, fig. 7.—SMITH, Jl. de Conch., XXII, 1874, pl. IV, fig. 1.—CLESSIN, Conch. Cab. Ano., 1876, p. 205, pl. LXVII, fig. 4.

Platiris (Mycetopus) rugatus LEA, Syn., 1870, p. 90.

Solenaia rugata SIMPSON, Syn., 1900, p. 657.

Sowerby gives no measurements or any account of the interior of this shell. The beaks are higher than in any species I know of, and there are two decided ridges radiating from them, that in front being rounded, that behind angular.

Group of *Solenaia triangularis*.

Shell short, rounded on post-base; very narrow in front.

SOLENAIA TRIANGULARIS (Heude).

Shell comparatively short, thin, subtriangular, compressed, being much wider behind than in front; dorsal and basal lines nearly straight; posterior end obliquely truncated above, rounded below; beaks low but apparently sharp, placed near the anterior end and lightly corrugated; anterior muscle scars round; posterior scars pyriform; nacre pale blue.

Length 44, height 20, diam 12 mm.

China.

Mycetopus triangularis HEUDE, Conch. Fluv. Nank., IX, 1885, pl. LXXII, fig. 138.

Solenaia triangularis SIMPSON, Syn., 1900, p. 657.

Quite different from the other species, being much shorter, rounded on the post-basal termination, having sharp beaks and well-defined muscle scars. Heude says nothing about the color of the epidermis.

SOLENAIA CARINATA (Heude).

Heude figures a fossil fragment of what is apparently a very large *Solenaia*, but it may not be a recent species and it is not in a condition to be described.

China.

Mycetopus carinatus HEUDE, Conch. Fluv. Nank., III, 1877, pl. XXI, fig. 45.

Solenaia carinata SIMPSON, Syn., 1900, p. 657.

Genus GONIDEA Conrad, 1857.

Gonidea CONRAD, Pr. Ac. Nat. Sci. Phila., 1867, p. 165.

Shell elongated, subtriangular, much narrowed in front, wide behind, inflated, subsolid, with a high, sharp posterior ridge; beaks rather sharp but not high, the sculpture consisting of a few, strong, concentric bars; hinge with a rudimentary pseudocardinal and lateral in each valve, though these are sometimes wanting; dorsal scars forming a row within the shallow beak cavity; muscle scars irregular; pallial line with a trace of a sinus behind; nacre lurid to purplish.

Animal having the outer gills larger than the inner behind, narrower in front, inner free from the abdominal sac, all united to the mantle nearly to their posterior points; mantle double edged; branchial opening large, a few irregular, large and small branched papillæ on it; anal opening large, with rudimentary papillæ; superanal opening closed a long way below; foot very large when living. No ova were found in the branchiæ of numerous specimens taken at different dates and localities.

Type, *Anodonta randalli* Trask and *A. feminalis* Gould.

GONIDEA ANGULATA (Lea).

Shell elongated, somewhat triangular, narrowed in front and wide behind, inequilateral, subsolid, generally inflated behind and tapering like a wedge to the anterior end; beaks

only moderately full and elevated, their sculpture a few strong bars running nearly parallel with the growth lines, posterior ridge usually very high, often pinched up into a sharp carina and ending behind at the base of the shell in a point; posterior end obliquely truncated; surface generally having rude, uneven growth lines; epidermis yellowish-green to blackish, when light colored sometimes banded or clouded with green, occasionally feebly rayed; hinge having a rudimentary, compressed, smooth tooth in each valve in the region of the beaks and in young shells there are commonly vestiges of laterals; beak cavities shallow, with scattered dorsal scars; anterior muscle scars irregular, often separated; nacre lurid purplish or purple brown, not iridescent.

Length 93, height 44, diam. 35 mm.

Length 93, height 48, diam. 30 mm.

Central California; north to British Columbia; east to Idaho. Type locality, Lewis' River.

Anodonta angulata LEA, Tr, Am. Phil. Soc., VI, 1838, p. 97, pl. XVI, fig. 52; Obs., II, 1838, p. 97, pl. XVI, fig. 52.—HANLEY, Biv. Shells, 1843, p. 222, pl. XXIV, fig. 15.—CHENU, Man., 1859, II, p. 146, fig. 722.—REEVE, Elem. Conch., II, 1860, pl. XXXI, fig. 180.—CLESSIN, Conch. Cab. Ano., 1874, p. 159, pl. LIII, figs. 3, 4.—HEMPHILL, Zoe., I, 1891, p. 326. pl. X, figs. 5, 6.

Margarita (Anodonta) angulata LEA, Syn., 1838, p. 32.

Margaron (Anodonta) angulata LEA, Syn., 1852, p. 52; 1870, p. 83.

Anodon angulata CATLOW and REEVE, Conch. Nom., 1845, p. 66.

Gonidea angulata SIMPSON, Syn., 1900, p. 658.

Anodon angulatus SOWERBY, Conch. Icon., XVII, 1867, pl. III, fig. 6.

Anodon feminalis GOULD, Pr. Bost. Soc. N. Hist., III, 1850, p. 293.

Anodonta feminalis GOULD, U. S. Expl. Exp., XII, 1852, p. 436, figs. 547, 547*a*, 547*b*.

Anodonta randalli TRASK, Pr. Cal. Ac. N. Sci., I, 1855, p. 29.

Anodon biangulata SOWERBY, Conch. Icon., XVII, 1869, pl. XXIII, figs. 8, 8*a*, 8*b*.

Anodonta biangulata CLESSIN, Conch. Cab. Ano., 1876, p. 234, pl. LXXVII, fig. 3.

An exceedingly variable and apparently aberrant form. In most specimens the posterior ridge is the most striking character, being high, sharp and often pinched up. Occasionally it is lower and somewhat double and rarely it is scarcely developed at all. Sometimes the species lives in rapidly running water, the anterior part buried in the hard bottom as far as the posterior ridge, which runs on a level with the surface of the bottom, the posterior end pointing down stream. It is probable that specimens living in such environment have a strong, high posterior ridge and that those found in comparatively still water have it much less developed. I have a photograph sent by Mr. Henry Hemphill of a shell in which the posterior ridge is almost wanting and such specimens are usually thinner than those with the high ridge, an evidence of living in stiller water. The form of the shell, the habits of the animal and its large foot would hint at a relation with *Solenaia*.

Var. *subangulata* (Hemphill).

"In general outline this form recalls at once its nearest relative, *A. angulata* Lea. Compared with that species, it is more oval in outline; the ridge or angle radiating from the umbones to the anterior (posterior) ventral margin of the shell is nearly or quite obsolete in the specimens before me; the anterior margin of the shell is more produced on its dorsal edge, while its ventral edge is more rounded at the point where the angle terminates, and the intervening space between the angle and the front margin of the shell is less concave in form. The shell is also less pointed and more rounded in its posterior outline, and is much less inflated in general form. In color and lines of growth the two shells agree fairly well

Compared with *Anodonta oregonensis* Lea, its next nearest relative, our variety is just the reverse in outline. It is broader

in front (behind) from its dorsal to its ventral margin and narrower behind (in front) while *A. oregonensis* is narrower in front (behind) from its dorsal to its ventral margin and broader behind (in front). *A. oregonensis* is also much more inflated and some of our varieties inclined to be cylindrical, while our variety is flat and compressed.

Length 3.5, height 1.75, diam. 7/8 inch." (Hemphill).

Type locality, Russian River, Putah Creek and Upper San Joaquin River, California.

Anodonta angulata var. *subangulata* HEMPHILL, Zoe, I, 1891, p. 325, pl. x, figs. 1-2.

Gonidea angulata var. *haroldiana* DALL, Smith. Misc. Coll., 50, 1908, p. 499.—HANNIBAL, Proc. Mal. Soc. London, X, 1912, p. 127, pl. VI, fig. 10.

The description of this form was unknown to me when the Synopsis was published. It will be noticed, as indicated above, that the author in preparing his description miscalled the anterior and posterior ends of the shell.

Anthony's *subangulata* was described as an *"Anodon"* and not as an *Anodonta*, and, therefore, does not prevent the retention of Hemphill's name.

Genus ANODONTOIDES Simpson (in Baker), 1898.

Anodontopsis SIMPSON, (in Baker), Tr. St. Louis Ac. Sci., VIII, 1898, p. 76; not *Anodontopsis* McCOY.

Anodontoides SIMPSON, (in Baker), Moll. Chicago, 1898, p. 72.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 293.

Shell elliptical, inflated, thin, with a faint posterior ridge; sometimes constricted at the center of the base; beaks rather full with a few coarse, subparallel, concentric ridges, which are curved up rather suddenly behind, and back of these there are fine radiating ridges; epidermis smooth, shining, often rayed; hinge line slightly incurved in front of the beaks, edentulous or bearing the merest rudiments of teeth; muscle scars shallow, irregular; nacre bluish-white.

Animal with marsupium occupying the outer and sometimes the four leaves of the branchiæ; ovules more numerous in the outer, the whole pad-like; gills large, inner semicircular, free from the abdominal sac, or united to it; branchial opening large, with many small papillæ; anal opening with well-developed papillæ.

Type, *Anodonta ferussaciana* Lea.

ANODONTOIDES FERUSSACIANUS (Lea).

Shell long elliptical, scarcely subsolid, inequilateral, subinflated; beaks full and high, sculptured with a few concentric ridges, which curve upward behind and are suddenly and angularly turned upward and forward, returning as fine raised threads to the nucleus and behind the other sculpture there are several radiating, raised liræ. Posterior ridge rounded or sometimes faintly biangulate, ending behind about on the median line; anterior end rounded; posterior end rounded, feebly pointed or biangulate; dorsal line slightly incurved in front of the beaks; basal line nearly straight, often faintly incurved in the middle; epidermis greenish, often faintly rayed; hinge line often a little swollen in front of the beaks where it is incurved, otherwise usually edentulous; nacre bluish-white or bluish, generally bright and iridescent. behind.

Length 86, height 45, diam. 34 mm.

Length 92, height 53, diam. 40 mm.

Mississippi drainage area generally; St. Lawrence River system; Red River of the North; Saskatchewan River; Connecticut?

Type locality, Ohio River, Cincinnati, O.

Anodonta ferussaciana LEA, Tr. Am. Phil. Soc., V, 1834, p. 45, pl. VI, fig. 15; Obs., I, 1834, p. 157, pl. VI, p. 15.—MUSGROVE, Phot. Conch., 1863, pl. I, fig. 15.—CLESSIN, Conch. Cab. Ano., 1873, p. 75, pl. XXIII, fig. 4.

Anodon ferussaciana DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 200, pl. XVI, fig. 230.—SOWERBY, Conch. Icon., XVII, 1867, pl. XIV, fig. 51.

Margarita (Anodonta) ferussaciana LEA, Syn., 1836, p. 51; 1838, p. 30.

Margaron (Anodonta) ferussaciana LEA, Syn., 1852, p. 50; 1870, p. 79.

Anodontoides ferussacianus BAKER, Moll. Chicago, Pt. 1, 1898, p. 72, pl. III, fig. 6; V, fig. 2.—SIMPSON, Syn., 1900, p. 659.

Anodonta argentea LEA, Pr. Am. Phil. Soc., I, 1840, p. 289; Tr. Am. Phil. Soc., VIII, 1842, p. 223, pl. XIX, fig. 41; Obs., III, 1842, p. 61, pl. XIX, fig. 41.—CLESSIN, Conch. Cab. Ano., 1876, p. 218, pl. LXXII, figs. 3, 4.

Margaron (Anodonta) argentea LEA, Syn., 1852, p. 50; 1870, p. 79.

Strophitus argenteus CONRAD, Pr. Ac. Nat. Sci. Phila., VI, 1853, p. 262.

Anodonta ferruginea LEA, Pr. Am. Phil. Soc., I, 1840, p. 289; Tr. Am. Phil. Soc., VIII, 1842, p. 225, pl. XIX, fig. 43; Obs., III, 1842, p. 63, pl. XIX, fig. 43.—MUSGROVE, Phot. Conch., 1863, pl. I, fig. 2.—CLESSIN, Conch. Cab. Ano., 1876, p. 219, pl. LXXII, figs. 5, 6.

Margaron (Anodonta) ferruginea LEA, Syn., 1852, p. 50; 1870, p. 79.

Anodon plicatus HALDEMAN, Jl. Ac. Nat. Sci. Phila., VIII, 1842, p. 201.

Margaron (Anodonta) plicata LEA, Syn., 1870, p. 79.

Anodonta denigrata LEA, Tr. Am. Phil. Soc., X, 1852, p. 285, pl. XXV, fig. 45; Obs., V, 1852, p. 41, pl. XXV, fig. 45.—CLESSIN, Conch. Cab. Ano., 1875, p. 210, pl. LXIV, figs. 4, 5.

Margaron (Anodonta) denigrata LEA, Syn., 1852, p. 50; 1870, p. 79.

Anodonta oblita LEA, Tr. Am. Phil. Soc., X, 1852, p. 290, pl. XXVIII, fig. 52; Obs., V, 1852, p. 46, pl. XXVIII, fig. 52.—CLESSIN, Conch. Cab. Ano., 1875, p. 165, pl. LIV, figs. 7, 8.

Margaron (Anodonta) oblita LEA, Syn., 1852, p. 50; 1870, p. 79.

Anodon subcylindracea SOWERBY, Conch. Icon., XVII, 1867, pl. XIV, fig. 47.

Anodonta subcylindracea CLESSIN, Conch. Cab. Ano., 1873, p. 92, pl. XXVI, figs. 6, 7.

Many specimens resemble certain forms of *Strophitus edentulus* so closely as to even deceive experts. Generally the shell is thinner than in that species, though I have before me an *A. ferussacianus* belonging to the Lea collection from Cincinnati, Ohio, which is as solid as any *Strophitus* I have ever seen. Usually the hinge of *A. ferussacianus* does not show quite as much of a development of teeth as does the *S. edentulus*, the shell is more nearly elliptical, is more evenly rounded behind, is straighter on the basal line and smoother than *edentulus*. Finally the beak sculpture is not so strong and wide as it is in the latter species. The character of the marsupia is very different in the two genera.

Var. *buchanensis* (Lea).

Shell smaller, more elongated and delicate than the type, more disposed to be biangulate and widened behind.

Length 76, height 36, diam. 27 mm.

St. Lawrence System.

Type locality, Buck Creek, O.

Anodonta buchanensis LEA, Tr. Am. Phil. Soc., VI, 1838, p. 47, pl. XIV, fig. 43; Obs., II, 1838, p. 47, pl. XIV, fig. 43.—SOWERBY, Conch. Icon., XVII, 1869, pl. XXIV, fig. 92.

Margarita (Anodonta) buchanensis LEA, Syn., 1836, p. 54; 1838, p. 32.

Margaron (Anodonta) buchanensis LEA, Syn., 1852, p. 51; 1870, p. 82.

Anodonta subcylindracea LEA, Tr. Am. Phil. Soc., VI, 1838, p. 106, pl. XXIV, fig. 117; Obs., II, 1838, p. 106, pl. XXIV, fig. 117.—WALTON, Moll. Monroe Co., 1892, p. 17, pl. VIII, fig. 3.

Margarita (Anodonta) subcylindracea LEA, Syn., 1838, p. 32.

Anodon subcylindracea DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 200, pl. XVI, fig. 229.

Margaron (Anodonta) subcylindracea LEA, Syn., 1852, p. 51; 1870, p. 82.

Anodontoides subcylindraceus BAKER, Moll. Chicago, Pt. 1, 1898, p. 74, pl. IV, fig. 4; VI, fig. 1.

Anodontoides ferussacianus var. *subcylindraceus* SIMPSON, Syn., 1900, p. 660.

I am doubtful whether the type of *Anodonta buchanensis* is in Lea's collection. There is a shell placed with a number of others (Museum number 86719) labeled "*Anodonta buchanensis*, Buck Creek, M. G. W.," which in size and general form is much like his figure of that species, but the outlines do not closely agree. The shells placed under this number vary between this and typical *ferussacianus*. It probably equals Lea's *A. subcylindracea*, the type of which I have not seen.

ANODONTOIDES MODESTUS (Lea).

Shell small, long obovate or subrhomboid, being a little wider behind than in front, thin or almost subsolid, inequilateral, subinflated; beaks moderately full and elevated, rather sharp, sculptured with a number of parallel, somewhat doubly-looped ridges, which turn up behind and return to the nucleus in the form of delicate raised threads; behind these there are a number of radial threads; posterior ridge subbiangular, almost double, ending behind below the median line in a feeble bianulation; base full just behind the middle, in front of it straight or a very little emarginate; surface with uneven growth lines; epidermis ashy-green with darker bands with two or three dark rays on the posterior slope; hinge line a very little incurved in front of the beaks where it is scarcely thickened; nacre bluish, subshining, iridescent behind.

Length 47, height 24, diam. 17 mm.

Type locality, Pond near Kalamazoo, Michigan.

Anodonta modesta LEA, Pr. Ac. Nat. Sci. Phila., 1857, p. 84; Jl. Ac. Nat. Sci. Phila., IV, 1860, p. 364, pl. LXIII, fig. 189; Obs., VIII, 1860, p. 46, pl. LXIII, fig. 189.—CLESSIN, Conch. Cab. Ano., 1874, p. 153, pl. XLIX, figs. 7, 8.

Margaron (Anodonta) modesta LEA, Syn., 1870, p. 79.

Anodon modestus SOWERBY, Conch. Icon., XVII, 1867, pl. X, fig. 26.

Anodontoides ferussacianus var. *modestus* SIMPSON, Syn., 1900, p. 660.

The type, which is in the Lea collection, is the only specimen I have seen, which I feel certain is the true *A. modesta* of Lea. It is nearly subsolid, is elongated, full at the base just behind the middle and slightly biangulate behind. The hinge is almost exactly like that of what is commonly called *Anodonta subcylindracea,* but the beak sculpture differs considerably, being finer and doubly looped. There are a number of other shells in the general collection of the National Museum, labeled *Anodonta modesta,* some of them by Dr. Lewis, which may be a variety of *A. pepiniana,* others are perhaps a form of the variety *buchanensis.* I am a little at a loss where to place the present form, which has all the characters of an *Anodontoides* except the beak sculpture.

ANODONTOIDES ELLIOTTII (Lea).

Shell somewhat elongated, subelliptical, rather inflated and thin, with a moderate subangular posterior ridge, inequilateral, the beaks rather full but not very high, their sculpture a few moderate ridges that curve up sharply behind; epidermis brownish or brownish-green, generally faintly rayed with lighter colored, narrow rays; hinge line slightly incurved in front of the beaks, with a rudimentary, compressed anterior tooth in each valve; without laterals; beak cavities not deep; muscle scars superficial; nacre bluish.

Length 73, height 38, diam. 28 mm.

Type locality, Chattahoochee River, Columbus, Georgia. Also Columbus, Mississippi.

Margaritana elliottii LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 138; Jl. Ac. N. Sci. Phila. IV, 1859, p. 226, pl. XXXI, fig. 108; Obs., VII, 1859, p. 44, pl. XXXI, fig. 108.

Margaron (Margaritana) elliottii LEA, Syn., 1870, p. 68.

Margaritana (Alasmodonta) elliottii CLESSIN, Conch. Cab. Ano., 1876, p. 267, pl. LXXXII, figs. 3, 4.

Strophitus elliottii SIMPSON, Syn., 1900, p. 619.

Margaritana elliptica LEA, Pr. Ac. N. Sci. Phila., III, 1859, p. 113; Jl. Ac. N. Sci. Phila., V, 1862, p. 106, pl. XVIII, fig. 254; Obs., VIII, 1862, p. 110, pl. XVIII, fig. 254.

Margaron (Margaritana) elliptica LEA, Syn., 1870, p. 68.

Margaritana (Alasmodonta) elliptica CLESSIN, Conch. Cab. Ano., 1876, p. 270, pl. LXXXI, figs. 5, 6.

Anodonta showalterii LEA, Pr. Ac. N. Sci. Phila., IV, 1860, p. 307; Jl. Ac. N. Sci. Phila., 1862, p. 215, pl. XXXIII, fig. 284; Obs., IX, 1863, p. 37, pl. XXXIII, fig. 284.—CLESSIN, Conch. Cab. Ano., 1874, p. 156, pl. LI, figs. 5, 6.

Anodon showalterii SOWERBY, Conch. Icon., XVII, 1870, pl. XXVII, fig. 104.

Margaron (Anodonta) showalterii LEA, Syn., 1870, p. 79.

Strophitus edentulus (part), SIMPSON, Syn., 1900, p. 617.

I placed this species in *Strophitus* with some doubt when I wrote the Synopsis. Since writing that I have seen other specimens, which show something of the beak sculpture, and I am rather inclined to believe that it is closely allied to *A. ferussacianus*. The teeth are better developed than in that species, but the nearly straight hinge line and the beak sculpture would seem to indicate that it is an *Anodontoides*. On comparing again Lea's *Anodonta showalterii* with his *Margaritana elliottii* I am satisfied that the two are identical, the former being merely a little more solid and having a slightly heavier hinge. I had overlooked the fact that Lea in describing the soft parts of the former states that the "Branchial uterus is filled with embryonic shells the whole length of the outer leaves" as in *Anodonta ferussaciana* and *not* as in *A. edentula*. The beak sculpture of this form is rather delicate.

Genus PEGIAS Simpson, 1900.

Pegias SIMPSON, Syn., 1900, p. 660.

Shell small, thickened in front, with a sharp posterior ridge, in front of which is a wide radial depression, ending in a basal sinus; above this ridge is another, making the shell decidedly biangulate and truncate behind; beak sculpture consisting of

subconcentric corrugations, generally swollen on the posterior ridge; epidermis decorticated, but showing a few dark, radial rays on the base of the shell; pseudocardinals rather solid; laterals wanting. Animal having the marsupium empty in the specimen examined; inner gills larger in front, free from the abdominal sac, all four truncated behind; palpi large; mantle with square spots on its edge; branchial opening with a few large papillæ; anal opening smooth, not separated from the superanal.

Type, *Margaritana fabula* Lea.

PEGIAS FABULA (Lea).

Shell oblong, subcompressed, solid, inequilateral; beaks not very full or high but pointed, sculptured with four or five very strong folds, which run parallel with the growth lines or are slightly oblique; posterior ridge angular, ending behind in an angulation at the base of the shell; there is another ridge on the posterior slope near the dorsal line, which also ends behind in an angulation; posterior end truncated between these ridges either squarely or obliquely; often the upper point extends beyond the lower one; base line generally incurved in front of the posterior ridge; epidermis decorticated, rayed below and behind, often widely below; left valve with an irregular triangular tooth under the beak, sometimes with a vestige of another in front of it; right valve with one tooth in front of the beak; laterals wanting or represented by mere blurred, faint ridges; beak cavities rather deep, compressed; anterior muscle scars impressed; nacre whitish on the anterior border, flesh-colored or salmon in the cavities, greatly and suddenly thickened in front.

Length 35, height 22, diam. 12 mm.

Length 30, height 16, diam. 11 mm.

Cumberland and Tennessee River systems.

Type locality, Cumberland River, Tenn.

Margarita (Margaritana) fabula LEA, Syn., 1836, p. 46; 1838, p. 28.

Margaritana fabula LEA, Tr. Am. Phil. Soc., VI, 1838, p. 44, pl. XIII, fig. 39; Obs., II, 1838, p. 44, pl. XIII, fig. 39.—KUSTER, Conch. Cab. Unio, 1862, p. 301, pl. c, fig. 3.

Unio fabula HANLEY, Biv. Shells, 1843, p. 213, pl. XXII, fig. 45. —SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVI, fig. 394.

Margaron (Margaritana) fabula LEA, Syn., 1852, p. 44; 1870, p. 70.

Micromya fabula AGASSIZ, Arch. für Nat., I, 1852, p. 47.

Strophitus fabula CONRAD, Pr. Ac. Nat. Sci. Phila., VI, 1853, p. 263.

Baphia fabula H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 499.

Pegias fabula SIMPSON, Syn., 1900, p. 661.

Margaritana curreyana LEA, Pr. Ac. Nat. Sci. Phila., I, 1840, p. 288; Tr. Am. Phil. Soc., VIII, 1842, p. 223, pl. XVIII, fig. 40; Obs., III, 1842, p. 61, pl. XVIII, fig. 40.—KUSTER, Conch. Cab. Unio, 1862, p. 300, pl. c, fig. 2.

Micromya curreyana AGASSIZ, Arch. für Nat. I, 1852, p. 47.

Margaron (Margaritana) curreyana LEA, Syn., 1852, p. 42; 1870, p. 68.

Strophitus curreyana CONRAD, Pr. Ac. N. Sci., Phila., VI, 1853, p. 263.

Baphia curreyana H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 499.

Unio curreyana SOWERBY, Conch. Icon., XVI, 1868, pl. LXIII, fig. 319.

Unio curreyanus HANLEY, Biv. Shells, 1856, p. 386, pl. XXIV, fig. 10.

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

A remarkable form, which seems to be related to some of the Alasmidontas, but differs from all of them in a number of characters. Its texture and epidermis are unlike any species that I know of. Usually much of the epidermis is decorticated, even in young shells, leaving a grayish or ashy surface exposed. It often remains in the sinus near the base in front of the posterior ridge, where it shows a very wide dark ray or blotch, and when present on the posterior end it quite commonly shows

rays. The beak sculpture is remarkably strong, often extending well on to the body of the shell in oblique ridges. The posterior truncation between the two ridges may be square or the upper point may project far beyond the lower one. The teeth are much as in *Alasmodonta*, but the texture and decided thickening of the nacre in front as well as the decided truncation of all four of the gills behind are peculiar.

Genus ARCIDENS Simpson, 1900.

Arcidens Simpson, Syn., 1900, p. 661.—Ortmann, Ann. Car. Mus., VIII, 1912, p. 284.

Shell subsolid, inflated, subrhomboid, with full, high beaks; beak sculpture very strong, consisting of irregular corrugations, which fall into two loops, at the bases of which the ridges are swollen into knobs that continue out in two radiating rows on to the disk of the shell; in front of and behind the beaks are many fine, radial wrinkles, the posterior ones being zigzagged; surface of the shell covered with oblique folds and wrinkles; epidermis dark olive, shining; there are two elongated, compressed pseudocardinals in the left valve, the posterior under the beak, and curved upward, cutting off the hinge plate in the right valve, which has a single, compressed pseudocardinal in front; laterals numerous, short, blurred; muscle scars irregular; nacre white. Animal with the gills very large, rounded below; inner the larger, free from the abdominal sac; marsupium filling the outer gills, of a peculiar, granular texture; palpi very large, elongated, attached half way to the mantle; mantle with a thick, unspotted border; branchial opening large, papillose; anal opening with rudimentary papillæ.

Type, *Alasmodonta confragosa* Say.

Arcidens confragosus (Say).

Shell rhomboid, inflated, subsolid, or solid, slightly inequilateral; beaks high and full, their sculpture consisting of irregular, doubly-looped ridges, the bases of the loops being developed into strong, pinched-up nodules, which extend out on to the disk of the shell; in front of and behind the loops there are

a number of radiating, wavy, subnodulous liræ or small ridges; from the anterior row of knobs extending backwards and downwards there is a series of strong folds and these are crossed by wrinkled, radiating, sometimes zigzagged, threads; the posterior slope has radial, wrinkled sculpture, while the anterior base has usually merely concentric striæ; posterior ridge rather high; post-dorsal region almost winged; epidermis brownish-green with dark bands, sometimes clouded; left valve with an arched, somewhat elongated tooth under the beak, which often curves upward; in front of this there is a compressed tooth; right valve with a strong, subcompressed tooth in front of the beak; at the beak the hinge plate is cut away for the reception of the tooth in the left valve; laterals reduced to blurred, uneven vestiges; beak cavities deep; muscle scars shallow; nacre bluish-white, dull, often with uneven radial sculpture, with a wide prismatic border.

Length 100, height 75, diam. 48 mm.

Mississippi River and states adjoining it; Ohio River drainage; southwest to Colorado River, Texas; Bayou Teche, Louisiana; ? Enterprise, southeastern Alabama.

Type locality, New Orleans, La.

Alasmodonta confragosa SAY, N. Harm. Diss., II, 1829, p. 339; Am. Conch., I, 1830, pl. XXI.—CHENU, Bib. Conch., 1st ser., III, 1845, p. 30, pl. VIII, figs. 1, 1*a*.

Margarita (Margaritana) confragosa LEA, Syn., 1836, p. 43; 1838, p. 27.

Unio confragosa DESHAYES, An. sans Vert., 2d ed., VI, 1835, p. 552.—HANLEY, Biv. Shells, 1843, p. 210, pl. XXIII, fig. 52. —DESHAYES, Tr. Elem., 1853, p. 217, pl. XXX, figs. 5-7.

Baphia confragosa H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 500.

Margaron (Margaritana) confragosa LEA, Syn., 1852, p. 42; 1870, p. 67.

Margaritana confragosa CALKINS, Pr. Ottawa Acad., 1874, p. 46.

Unio confragosus SOWERBY, Conch. Icon., XVI, 1867, pl. LX, fig. 209.

Arcidens confragosus SIMPSON, Syn., 1900, p. 661.—ORTMANN, Ann Car. Mus., VIII, 1912, p. 284, figs. 12-12*a*.

A remarkable form, which does not seem to be very closely related to any other known species, except the recently described *Arkansia wheeleri*. The sculpture is exceedingly complicated, that of the beaks with the two rows of nodules being something as it is in *Quadrula lachrymosa*. The oblique wavy folds recall those of the *plicata* group of *Quadrula*, but the teeth do not show any affinity to this group. The radial wrinkles and sulcations differ from those of any species I know of.

In the only gravid specimen I have seen the marsupium presented a peculiar striated, granular structure, different from that of any Naiad I know. It was narrowed in the middle, and produced into a sort of lobe behind, but, though the specimen seemed to be a perfectly normal one, I am in doubt whether this peculiar form is constant. I do not think that this granulation is the result of a diseased condition.

Genus ARKANSIA Ortmann and Walker, 1912.

Arkansia ORTMANN and WALKER, Naut. XXV, 1912, p. 97.

"Shell moderately thick, subrotund to subovate or subrhomboidal, inflated, with full beaks. Disk sculptured with irregular, oblique folds, which are sometimes indistinct. Beak sculpture poorly developed, consisting of two to three double-looped bars, the loops slightly swollen or tubercular, disappearing toward the disk and not continuous with the sculpture of the latter. Hinge well developed, with strong pseudocardinals, a very strong interdental projection in the left valve and well developed, strong, but rather short laterals.

Soft parts: Supra-anal opening separated from the anal by a mantle connection, which is somewhat variable, but rather long (a little shorter to somewhat longer than the anal; the supra-anal is correspondingly longer or shorter; in one case there is a double mantle connection). Mantle edges, between the anal and branchial, drawn together by the gill-diaphragm but not united. Inner edge of anal almost smooth, that of the branchial with papillæ.

Outer lamina of outer gills connected with mantle to its posterior end, and thus the gill-diaphragm is complete. Anterior end of inner gills located about midway between the posterior base of the palpi and the anterior end of the outer gills. Inner lamina of inner gills free from the abdominal sac, except for a short distance at the anterior end. Palpi of medium size, subfalcate, their posterior margins connected for about one-third of their length.

Gills with well-developed septa and water-tubes. The septa are rather distant in the male and in the inner gill of the female. The outer gill alone is marsupial in the female, with very close septa. Edge of marsupium with slightly thickened tissue, indicating that it is capable of being stretched out when gravid.

Type, *Arkansia wheeleri* Ortmann and Walker.

ARKANSIA WHEELERI Ortmann and Walker.

"Male and female shells alike. Shell subrotund to subovate or subrhomboidal, inflated, rather thick and solid; dark reddish-brown or black, usually lighter toward the beaks, which in young shells are chestnut-colored; epidermis with a silky luster; beaks very prominent, projecting anteriorly and incurved over the large lunule, their sculpture consisting of two or three double-looped bars, the loops slightly swollen or tubercular; sculpture restricted to the extremity of the beaks, the remainder of the umbonal region being entirely smooth; posterior half of the disk sculptured with irregular, oblique folds, sometimes nearly obsolete, which on the dorsal slope curve upwards, and in front of the posterior ridge are crossed by numerous, irregular, radiating, small folds or wrinkles at right angles to the lines of growth; anterior portion of the disk smooth; anterior margin nearly straight in front of the beaks, then projecting in a regular curve, which continues around the basal margin until it meets the posterior margin at an obtuse angle about one-third up from the base; hinge margin nearly straight; posterior margin slightly curved; posterior ridge not prominent, usually rounded, but sometimes obscurely biangulate; hinge complete; pseudocardinals strong, ragged, in the left valve,

two, not strongly differentiated and coalescing along the hinge line, the anterior narrow and parallel with the hinge line, the posterior somewhat wider and heavier and scarcely separated from a strong projection of the interdentum, which is continuous with the lower lateral and slopes gradually to its extremity; upper lateral low, the groove between them deep and extending nearly to the beak; a single, strong pseudocardinal in the right valve with a deep pit behind it to receive the anterior pseudocardinal of the left valve, interdentum cut away to make room for the interdental projection in the left valve; a single strong, but rather short lateral; ligament dark brown; muscle scars not very deep, those of the anterior adductor and posterior adductor large, those of the anterior retractor and pedal protractor rather small and inconspicuous; cavity of the beaks very deep; nacre usually salmon-colored above the pallial line, bluish-white below (sometimes entirely white) and rather thin, slightly iridescent with a wide, dark prismatic border.

Length (of type) 73.5, height 62, diam. 41 mm." (O. & W.)

Arkansia wheeleri ORTMANN and WALKER, Naut., XXV, 1912, p. 98, pl. VIII.

"The shell characters of this fine species and most interesting addition to our fauna are very peculiar and can be compared only with *Arcidens,* to which genus, *Arkansia,* undoubtedly, is the closest affinity. In general, the external appearance is quite similar, and in both the smaller series of radiating wrinkles and the curved folds of the dorsal slope are very much alike. But *Arkansia* is a much heavier and more inflated shell, with the beaks fuller, more projecting and more anterior, and the strong, oblique folds, like those of *Quadrula plicata,* are peculiarly its own. It differs, also, entirely in the beak sculpture, which is comparatively simple and confined to the extremity of the beak, and is quite similar to that of certain *Quadrulæ.* In hinge characters it differs in having strong, well-developed laterals. In the presence of the interdental process in the left valve and the cutting away of the interdentum in the right valve opposite it, it is related to both *Arcidens* and *Symphynota.*

The smallest specimen examined (in Mr. Wheeler's collection), measures: length 35, height 33, and diam. 23 mm., being almost circular in shape, and looks, externally, very like a young, smooth *Q. pustulosa* Lea, the oblique folds being only slightly evident in the post-basal region.

A very large specimen, also in Mr. Wheeler's collection, measures: length 87, height, 73, and diam. 48 mm.

The structure of the soft parts agrees entirely with that of the subfamily *Anodontinæ*, chiefly so the mantle edge and the outer marsupial gill. Unfortunately only sterile females have, as yet, been obtained, but it is hoped and expected that this deficiency will soon be remedied."

Genus SYMPHYNOTA Lea, 1829.

Symphynota LEA, Tr. Am. Phil. Soc., III, 1829, p. 424.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 280.

? Megadomus SWAINSON, Tr. on Mal., 1840, p. 266.

? Complanaria SWAINSON, Tr. on Mal., 1840, p. 290.

Shell elliptic rhomboid, compressed; beaks low, their sculpture consisting of strong bars; one pseudocardinal in the right valve and two in the left, the hinder somewhat A-shaped, cutting off the hinge plate in the right valve; laterals generally imperfect.

Animal having the gills semicircular below, inner the larger, free nearly the whole length from the abdominal sac; marsupium thick, pad-like, filling the outer gills; mantle strongly attached at pallial line; branchial opening papillose; anal opening without papillæ.

Type, *Symphynota compressa* Lea.

As I have constituted it, this group contains a few compressed species of Uniones from the United States with flattened, strongly sculptured beaks. The left valve usually has a strong uneven tooth under the beak that is somewhat A-shaped and this fits into the opposite valve cutting off its hinge line. There is another tooth in the front part of the left valve and one before the beak in the right and the laterals are gen-

erally badly blurred. The genus seems to be naturally divisible into three groups, which deserve subgeneric rank. The typical Symphynotas, which are thin to subsolid with doubly-looped beak sculpture and have tolerably well-developed laterals; *Lasmigona* with strong, straight, barred beak sculpture and radial plications on the posterior slope, and *Pterosygna* typified by the old *Margaritana complanata* of Barnes with heavy hinge, obovate shell and strong, doubly-looped beak sculpture. Although these three groups differ much from each other, yet many specimens may be found, which connect them. Occasionally *Symphynota costata* is destitute of posterior plications and may have fairly well-developed laterals, and I have before me a heavy *S. compressa* with teeth almost exactly like those of *costata* and I have seen specimens of *S. complanata,* which were quite elongated.

KEY TO SPECIES OF SYMPHYNOTA.

Shell solid.
- Obovate, or short elliptical, teeth very heavy. *S. complanata.*
- Rhomboid, costate behind. *S. costata.*

Shell thin to subsolid.
- Much compressed. *S. compressa.*
- Not compressed, large, dark. *S. charlottensis.*
- Long rhomboid, compressed, teeth well developed. *S. decorata.*
- Subcompressed, shining, teeth rudimentary. *S. quadrata.*
- Small, distinctly biangulate behind. *S. neglecta.*
- Not distinctly biangulate. *S. viridis.*

Subgenus SYMPHYNOTA, s. s.

Shell smooth, subsolid, shining, rayed; teeth delicate; laterals compressed, moderately developed.

SYMPHYNOTA COMPRESSA Lea.

Shell long rhomboid, subcompressed or compressed, thin to subsolid, somewhat inequilateral; beaks low, usually flattened, their sculpture consisting of numerous wavy, more or less

doubly-looped ridges; the anterior ends of the ridges corrugated and subnodulous; behind the ridges there are several fine, radial, raised threads; posterior ridge low, double and ending behind at or near the base of the shell in a wide, feeble biangulation; above this the posterior slope is obliquely truncated; dorsal line nearly straight, joining the posterior truncation at an angle; basal line slightly curved or sometimes straight; surface with uneven growth lines; epidermis usually yellowish-green or greenish-yellow, somewhat rayed, rarely ashy or brownish, subshining; left valve with a compressed, A-shaped tooth under the beak, which is reflexed, with a compressed tooth in front of it, with two or three, more or less perfect, delicate laterals; right valve with a compressed tooth in front of the beak, the hinge line cut off under the beak and one or two laterals; nacre bluish-white, buff or yellowish in the cavities, dull, prismatic border wide.

Length 104, height 60, diam. 30 mm.

Length 105, height 56, diam. 30 mm.

Length 82, height 46, diam. 27 mm.

Ohio and St. Lawrence drainage areas; west to Nebraska, north through eastern Iowa to Wisconsin; Hudson River.

Type locality, Ohio; Norman's Kill, Albany, N. Y.

Symphynota compressa LEA, Tr. Am. Phil. Soc., 1829, p. 450, pl. XII, fig. 22; Obs., I, 1834, p. 64, pl. XII, fig. 22.—SIMPSON, Syn., 1900, p. 662.

Complanaria compressa CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 261.

Microcondylæa compressa PÆTEL, Conch. Sam., III, 1890, p. 175.

Unio compressus CONRAD, Monog., VIII, 1837, p. 71, pl. XL, fig. 1.—HANLEY, Biv. Shells, 1843, p. 174, pl. XX, fig. 39.—DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 191, pl. XXI, fig. 245.—KUSTER, Conch. Cab. Unio, 1861, p. 198, pl. LXIV, figs. 3, 4.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXI, fig. 303.

Margarita (Unio) compressus LEA, Syn., 1836, p. 11; 1838, p. 13.

Complanaria compressus AGASSIZ, Arch. für Nat., I, 1852, p. 48.

Complanaria alasmodontina STIMPSON, Shells of N. Eng., 1851, p. 14.

Unio alasmodontinus PÆTEL, Conch. Sam., III, 1890, p. 144.

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

Unio pressus H. and A. ADAMS, Gen. Rec. Moll., II, 1858, p. 498.

Alasmodonta pressa BAKER, Tr. Ac. N. Sci. St. L., VIII, 1898, p. 76, fig.; Moll. Chicago, Pt. 1, 1898, p. 58, pl. VI, fig. 3; X, fig. 4.

Var. *plebia* (C. B. Adams).

Shell very much smaller than the type; base line straight or a little incurved; posterior ridge rather high; epidermis dull, ashy, pale lurid or smoky-brown; hinge teeth imperfect.

Length 48, height 24, diam. 13 mm.

Vermont; Montreal River; Lake Superior.

Type locality, Middlebury, Vt.

Unio compressus var. *plebius* C. B. ADAMS, F. W. and L. Shells of Vt., p. 16.

Symphynota compressa var. *plebius* SIMPSON, Syn., 1900, p. 663.

This is a very variable species in size, form, coloring, and the development of the teeth. Specimens before me have the disk somewhat radially corrugated and this character is occasionally seen on the posterior slope. In some cases, the beak sculpture is strong, consisting of nearly straight bars like that of *S. costata*. The shell is usually less solid than that species, but rather ponderous specimens occasionally occur. Ordinarily the laterals are fairly well developed, but sometimes they are much split up and blurred. I have seen specimens of what I believe to be the variety *plebia* of C. B. Adams from the northeast shore of Lake Superior, which were contributed by Mr. Jas. H. Ferriss. They are very small, a little more inflated than the type and dull smoky or ashy-green.

SYMPHYNOTA CHARLOTTENSIS (Lea).

Shell long rhomboid, somewhat inequilateral, subsolid, convex; beaks slightly raised above the dorsal line, not inflated, their sculpture consisting of doubly-looped, subnodulous ridges, the anterior loop rounded, the posterior short and angular; post-dorsal region raised almost into a low wing, angular above, subtruncate behind; posterior ridge full, sometimes double, ending behind below the median line, usually in a feeble biangulation; basal line a little curved or straight; anterior end rounded and narrowed; surface concentrically striate; epidermis bottle-green to brown-green, sometimes clouded and banded or feebly rayed; left valve with a compressed, uneven tooth under the beak that, when well developed, is reflexed and inclined to be A-shaped, with another low tooth in front; right valve with a compressed pseudocardinal; two laterals in the left valve and one in the right; they are sometimes blurred; nacre flesh or straw-color, often dirty purplish in the cavities.

Length 114, height 67, diam. 35 mm.

Type locality, Charlotte, Mecklinburg Co., N. C.

Unio charlottensis LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 191; Jl. Ac. N. Sci. Phila., VI, 1866, p. 8, pl. II, fig. 5; Obs., XI, 1867, p. 12, pl. II, fig. 5.

Margaron (Unio) charlottensis LEA, Syn., 1870, p. 51.

Symphynota charlottensis SIMPSON, Syn., 1900, p. 663.

Most nearly allied to *S. compressa,* but it is darker colored, a little more inflated, has different beak sculpture and nacre.

SYMPHYNOTA VIRIDIS (Conrad).

Shell subrhomboid, subsolid or rather thin, subcompressed or convex, inequilateral; beak sculpture of irregular, corrugated ridges, which are subnodulous and inclined to fall into two loops, with a few radial threads behind; posterior ridge low, very slightly double, ending behind near the base in a scarcely perceptible biangulation; base line generally a little curved, often full behind the middle; post-dorsal slope subtruncated; surface with irregular growth lines; epidermis yellowish or brownish-green, often feebly rayed, sometimes sub-

shining, often dull; left valve with one or more blurred teeth at and in front of the beak, the hinder in perfect examples is compressed and reflexed, with one or more delicate, imperfect laterals; right valve with one compressed pseudocardinal, which often has irregular denticles behind it, and one lateral; nacre bluish-white, often buff or straw-tinted.

Length 60, height 33, diam. 19 mm.

Streams draining into the Atlantic from New York south to North Carolina.

Type locality, Juniata River, Pa.

Unio viridis CONRAD, Monog., IV, 1836, p. 35, pl. XVII, fig. 1. —SOWERBY, Conch. Icon., XVI, 1866, pl. XLV, fig. 244.

Symphynota viridis SIMPSON, Syn., 1900, p. 663.

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

Unio tappanianus LEA, Tr. Am. Phil. Soc., VI, 1838, p. 62, pl. XVII, fig. 55; Obs., II, 1838, p. 62, pl. XVII, fig. 55.—HANLEY, Biv. Shells, 1843, p. 209, pl. XXI, fig. 38.—DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 194, pl. XX, fig. 242.—CHENU, Ill. Conch., 1858, pl. XX, figs. 2, 2*a*, 2*b*.—KUSTER, Conch. Cab. Unio, 1862, p. 270, pl. XCI, fig. 3.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 89, fig. 185.

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

Unio tappianus CATLOW and REEVE, Conch., Nom., 1845, p. 64.

Unio hyalinus LEA, Pr. Am. Phil. Soc., IV, 1845, p. 164; Tr. Am. Phil. Soc., X, 1848, p. 69, pl. II, fig. 4; Obs., IV, 1848, p. 43, pl. II, fig. 4.—KUSTER, Conch. Cab. Unio, 1861, p. 204, pl. LXVIII, fig. 3.

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

Unio pertenuis LEA, Pr. Ac. N. Sci. Phila., VII, 1863, p. 193; Jl. Ac. N. Sci. Phila., VI, 1866, p. 8, pl. II, fig. 4; Obs., XI, 1867, p. 12, pl. II, fig. 4.

Margaron (Unio) pertenuis LEA, Syn., 1870, p. 62.

Smaller and less distinctly rhomboid than *S. pressus*. The pseudocardinals are not so perfect as they are in that species.

The name *viridis* is credited to Rafinesque by most authors, but his description of that species is not sufficiently clear to distinguish it from other members of the group; besides, this form belongs exclusively in the Atlantic drainage and not in the Ohio River Valley, Rafinesque's locality. I cannot see any specific difference between this and Lea's *Unio hyalinus* and his *pertenuis*, which seem to me to be merely southern specimens of this form.

SYMPHYNOTA DECORATA (Lea).

Shell long rhomboid, scarcely subsolid, subcompressed, inequilateral; beaks low, not inflated, their sculpture consisting of doubly-looped, subnodulous ridges with a few radiating threads behind; posterior ridge low, double, ending behind just at or above the base in a biangulation; surface with delicate, concentric striæ; epidermis yellowish-green or greenish-yellow with wavy, green rays, subshining; left valve with an irregular, arched tooth under the beak and a small one in front, with two delicate laterals; right valve with a compressed pseudocardinal and one lateral; nacre bluish or pinkish-white.

Length 60, height 35, diam. 18 mm.

Length 74, height 42, diam. 23 mm.

Virginia to South Carolina.

Type locality, Abbeville District, S. C.

Unio decoratus LEA, Tr. Am. Phil. Soc., X, 1852, p. 257, pl. XIII, fig. 6; Obs., V, 1852, p. 13, pl. XIII, fig. 6.—SOWERBY, Conch. Icon., XVI, 1868, pl. XCI, fig. 496.

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

Symphynota decorata SIMPSON, Syn., 1900, p. 664.

Unio insolidus LEA, Pr. Ac. N. Sci. Phila., II, 1872, p. 159; Jl. Ac. N. Sci. Phila., VIII, 1874, p. 40, pl. XIII, fig. 37; Obs., XIII, 1874, p. 44, pl. XIII, fig. 37.

I believe that Lea's *Unio decoratus* is the same as his *U. insolidus*. The former is not quite so distinctly biangulate behind as the latter, though a second specimen from the type locality is more biangulate than the type. I can see no essen-

tial difference in the teeth or other characters. It is smaller than *charlottensis* and rather more compressed, is lighter colored and smoother.

SYMPHYNOTA NEGLECTA (Lea).

Shell rhomboid, scarcely subsolid, convex, its greatest diameter being about midway of the length, and from this point it tapers regularly to the ends; beaks rather full but not high; posterior ridge double and angled; surface with delicate growth lines; epidermis pale greenish-yellow with faint green rays; left valve with two blurred pseudocardinals and two remote, feeble laterals; right valve with one subcompressed pseudocardinal and one well-developed lateral; nacre whitish, tinted purple, iridescent behind, slightly thicker in front.

Length 50, height 30, diam. 19 mm.

Type locality, Northern Alabama.

Unio neglectus LEA, Desc. 12 Uniones, 1843; Tr. Am. Phil. Soc., IX, 1846, p. 280, pl. XLII, fig. 10; Obs., IV, 1848, p. 88, pl. XLII, fig. 10.—KUSTER, Conch. Cab. Unio, 1861, p. 225, pl. LXXVI, fig. 4.

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

Symphynota neglecta SIMPSON, Syn., 1900, p. 664.

Has better developed teeth and a more decided double posterior ridge than *S. quadrata*. The beak sculpture has not been seen in either of these shells.

SYMPHYNOTA QUADRATA (Lea).

Shell rhomboid, scarcely subsolid, subcompressed, somewhat inequilateral, with slightly elevated, rather compressed beaks, their sculpture not seen; posterior ridge rounded; surface with decided concentric sculpture; epidermis brownish-green with lighter and darker bands, slightly rayed and shining; left valve with an irregular, compressed, reflexed tooth under the beak and a vestigial one in front of it; right valve with a distinct, compressed pseudocardinal; laterals blurred

and feeble; nacre bluish-white, lurid in the cavities, with a distinct prismatic border.

Length 65, height 40, diam. 19 mm.

Type locality, Eastern Tennessee.

Margaritana quadrata LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 41; Jl. Ac. N. Sci. Phila., II, 1862, p. 210, pl. XXXII, fig. 279; Obs., IX, 1863, p. 32, pl. XXXII, fig. 279.

Margaron (Margaritana) quadrata LEA, Syn., 1870, p. 68.

Margaritana (Alasmodonta) quadrata CLESSIN, Conch. Cab. Ano., 1876, p. 273, pl. LXXXIII, figs. 5, 6.

Symphynota quadrata SIMPSON, Syn., 1900, p. 664.

This species approaches so nearly to *Alasmidonta* that it might almost as well be placed in it as the present group. Its teeth are better developed than are those of any member of that group, and the shell is more compressed. It approaches *decorata*, but the teeth are much less perfect.

Subgenus LASMIGONA Rafinèsque, 1831.

Lasmigona RAFINESQUE, Cont. Monog., 1831, p. 4.

Shell subrhomboid, compressed, corrugated behind; beaks low, their sculpture consisting of several coarse ridges, which generally fall into two slight loops, and often with radiating ridges in front and behind; epidermis shining; laterals partly developed, consisting of blurred ridges, which slope diagonally downward and backward on the hinge plate; cavities of the beaks shallow; dorsal scars faint, irregular.

Animal with the marsupium occupying the whole of the outer gills, very thick, like that of *Anodonta;* inner gills free all or the greater part of their length from the abdominal sac; branchial opening papillose; anal opening generally smooth or only slightly crenulate.

Type, *Alasmodonta costata* Rafinesque.

SYMPHYNOTA COSTATA (Rafinesque).

Shell long rhomboid, subcompressed, solid, inequilateral, with scarcely elevated, compressed beaks, their sculpture consisting of a few strong, straight or slightly doubly-looped

ridges; posterior ridge well developed, sometimes partly double; posterior slope covered with strong, corrugated, radial costations; hinder half of the disk often slightly corrugated; growth lines strong and irregular; epidermis yellowish-green, green, tawny or brownish, often rayed, dull or subshining; left valve with a strong, /\-shaped reflexed tooth under the beak, often with a low one in front of it; right valve with an irregular, subtriangular tooth in front of the beak, the hinge plate cut away behind it; laterals low and much blurred; muscle scars large, impressed, the anterior ones separate; nacre whitish or straw-colored.

Length 146, height 91, diam. 40 mm.

Length 124, height 57, diam. 30 mm.

Length 96, height 63, diam. 29 mm.

Mississippi drainage generally; St. Lawrence basin; Manitoba; Hudson River?; Columbus, Mississippi; Texas?

Type locality, Kentucky River.

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

Alasmodonta costata SAY, Am. Conch., VI, 1834.

Complanaria costata CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 261.

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

Alasmodonta rugosa BARNES, Am. Jl. Sci., VI, 1823, p. 278, pl. XIII, fig. 21.—BAKER, Moll. Chicago, Pt. 1, 1898, p. 57, pl. VII, figs. 1, 2; VIII, figs. 3, 4.

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

Margarita (Margaritana) rugosa LEA, Syn., 1836, p. 44; 1838, p. 27.

Unio rugosa HANLEY, Biv. Shells, 1843, p. 211, pl. XXI, fig. 8.

Alasmodon rugosa DE KAY, Zool. N. Y., Pt. 5, 1843, p. 196, pl. XIV, fig. 226.

Complanaria rugosa STIMPSON, Shells of N. Eng., 1851, p. 14.

Margaron (Margaritana) rugosa LEA, Syn., 1852, p. 42; 1870, p. 67.

Bephia rugosa H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 500.

Margaritana rugosa CALKINS, Pr. Ottawa Ac. Sci., 1874, p. 46.
Lasmigona rugosum RAFINESQUE, Cont. Mon., 1831, p. 5.
Unio rugosus KUSTER, Conch. Cab. Unio, 1861, p. 200, pl. LXVI, figs. 1-3.—SOWERBY, Conch. Icon., XVI, 1867, pl. LX, fig. 302.
Alasmodonta hians FERUSSAC, Guer. Mag., 1835, p. 25.

Very variable in form, sculpture, color, and solidity. It may almost always be separated from all other species at a glance by the peculiar curved, rounded, corrugated ridges of the posterior slope, but a specimen before me from Cincinnati, Ohio, is almost smooth in this region, having only a few low, faint nodules.

The description of *Alasmidonta costata* of Rafinesque so clearly covers the species described three years later as *Alasmodonta rugosa* by Barnes that the former name must be used.

Subgenus PTEROSYGNA Rafinesque, 1831.

Pterosygna RAFINESQUE, Cont. Monog., 1831, p. 5.

Shell large, ovate, rhomboid, inflated in post-basal region; beaks much compressed, their sculpture sharply and strongly doubly looped; epidermis dark, scarcely rayed; teeth very heavy.

Animal with an extremely thick marsupium; palpi large; mantle with small crenulations on lower border; branchial opening large; anal opening small, both slightly papillose.

Type, *Alasmodonta complanata* Barnes.

SYMPHYNOTA COMPLANATA (Barnes).

Shell large, solid, irregularly elliptical, obovate or subrhomboid, inequilateral, compressed; beaks low, decidedly flattened, their sculpture consisting of coarse, doubly-looped, subnodulous ridges with radiating raised threads behind; post-dorsal part of the young shell produced into a high, often angular wing, which is truncated behind making the outline at this period of growth somewhat triangular: as the shell becomes old this wing breaks off and is worn away; posterior ridge low, sometimes double and ending behind in a biangulation on the medi-

an line; base rounded, full behind the middle; surface with rude growth lines, often somewhat plicate on the posterior slope; epidermis dark green in young shells, blackened in old ones, scarcely shining; left valve with two strong, uneven pseudocardinals, the hinder generally divided, sometimes somewhat Λ-shaped; right valve with one or two pseudocardinals, which are frequently split up and imperfect; laterals very much blurred in both valves; muscle scars large; nacre white, thickened in front, with a wide border outside the pallial line.

Length 197, height 126, diam. 52 mm.

Length 126, height 52, diam. 33 mm.

Upper Mississippi drainage, as far south as Arkansas on the west; Ohio River system; upper St. Lawrence and its tributaries; north into the Mackenzie River.

Type locality, Wisconsin; Fox River.

Alasmodonta complanata BARNES, Am. Jl. Sci., VI, 1823, p. 278, pl. XIII, fig. 21.—BAKER, Moll. Chicago, Pt. 1, 1898, p. 60, pl. VIII, figs. 1, 2; IX, figs. 1-4.

Mya complanata EATON, Zool, Text-Book, 1826, p. 222.

Symphynota complanata LEA, Tr. Am. Phil. Soc., III, 1830, p. 448; Obs., I, 1834, p. 62.—SIMPSON, Syn., 1900, p. 665.

Margarita (*Margaritana*) *complanata* LEA, Syn., 1836, p. 43; 1838, p. 26.

Unio complanata HANLEY, Biv. Shells, 1843, p. 210, pl. XXI, fig. 9.

Complanaria complanata CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 261.

Baphia complanata H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 500.

Margaritana complanata CALKINS, Pr. Ot. Acad., 1874, p. 46.

Alasmodon complanatus SOWERBY, Conch. Man., 1842, p. 61, fig. 140.—KUSTER, Conch. Cab. Unio, 1861, p. 199, pl. LXV, fig. 1.—SOWERBY, Conch. Icon., XVI, 1866, pl. L, fig. 266.

Complanaria gigas SOWERBY, Conch. Man., 1839, fig. 141; 1842, p. 115, fig. 141.

? Megadomus gigas SWAINSON, Tr. on Mal., 1840, pp. 265, 378.

Var. *katherinæ* (Lea).

Shell much smaller than the ordinary manifestation of the species, irregularly elliptical or obovate and wanting the dorsal wing. The epidermis is smoky-brown; the beaks in the specimens I have seen are so badly eroded that I cannot form any idea of their sculpture. It seems to be the arctic manifestation of the species, which is so common in western rivers.

Length 90, height 62, diam. 23 mm.

Type locality, Lake Superior. Also Lake Winnipeg; Saginaw Bay, Michigan.

Unio katherinæ Lea, Syn., 1838, p. 35; Tr. Am. Phil. Soc., VI, 1839, p. 143.

Symphynota complanata var. *katherinæ* Simpson, Syn., 1900, p. 666.

One of the largest and most ponderous of the Naiades. The hinge is more solid and the form of the shell is more rounded than the other species I have placed in *Symphynota*. But occasional specimens have hinges much like that of *S. costata* and shells drawn out so that they approach *S. compressa* in form.

Genus ALASMIDONTA Say, 1818.

Monodonta Say, Nich. Enc., II, 1817.

Alasmidonta Say, Jl. Ac. N. Sci. Phila., I, 1818, p. 459.—Ortmann, Ann. Car. Mus., VIII, 1912, p. 294.

Alasmodonta Say, Nich. Enc., 3d ed., IV, 1819.

Uniopsis Swainson, Tr. on Mal., 1840, p. 382.

Shell generally rhomboid, inflated, with a well-developed posterior ridge, which ends in a point behind when it is single or a biangulation when double; beaks full and high, with coarse, concentric or slightly double-looped bars; epidermis rayed, shining; hinge with two pseudocardinals in the left valve and one in the right; laterals wanting or imperfect; cavity of the beaks deep; dorsal scars under the hinge plate; nacre bluish.

Animal with the marsupium occupying the entire outer gills; gills rounded below, inner much the larger, united to the abdominal sac, or free; mantle generally having square spots on

the posterior border; branchial opening papillose; anal opening smooth or crenulate.

Type, *Monodonta undulata* Say.

Say first called his genus *Monodonta,* but as that name was preoccupied he changed it to *Alasmidonta.* Later on he wrote the name *Alasmodonta* and this has been generally used by conchologists. The shells are generally more inflated than those of *Symphynota,* and the hinge of the right valve is not cut into behind the pseudocardinals as it is in that genus. In *Alasmidonta* the inner gills are united to the abdominal sac, while in *Symphynota* they are not united to it, a character, however, which is not to be greatly relied on. In the latter genus the marsupium is thick and pad-like and the mantle is strongly attached at the pallial line.

Key to species of Alasmidonta.

Posterior slope of the shell corrugated.
- Shell solid, truncated behind, much inflated. *A. marginata.*
- Shell subsolid, elongated, *A. raveneliana*
- Shell thin, rather short. *A. varicosa.*

Posterior slope not corrugated.
- Shell inflated.
  - Solid with strong teeth, *A. undulata.*
  - Thin, greatly inflated, rough and dark, *A. arcula.*
  - Moderately inflated, smooth. *A. triangulata.*
- Shell scarcely inflated.
  - Subsolid, dull, greenish, faintly rayed. *A. minor; calceolus.*
  - Dull brownish, rayless or feebly rayed. *A. holstonia; georgiana.*
  - Thin, sharply pointed behind, *A. heterodon.*
  - Generally spinose. *A. collina*

Subgenus ALASMIDONTA s. s.

Shell ovate-rhomboid, solid, inflated, shining, with very strong, generally concentric, beak sculpture; pseudocardinals solid, stumpy, somewhat radiately ridged; laterals short, very imperfect, or wanting; beak cavities deep, compressed.

Animal having the inner gills wider than the outer throughout; palpi long; marsupium loose and flabby, and having ova scattered throughout it in the only gravid specimen seen.

ALASMIDONTA UNDULATA (Say).

Shell elliptical or subrhomboid, subinflated, solid, inequilateral, with full, high beaks, whose sculpture consists of very strong ridges that run parallel with the growth lines; in front of and behind them there are often raised, radial threads; posterior ridge well developed, rounded, ending behind generally below the median line; surface with uneven growth lines; epidermis yellowish-green to dark brown or blackish, painted with wide and narrow rays, which are in old shells visible only by transmitted light, usually shining; left valve with a strong tooth under the beak and a small one in front; right valve with one irregular tooth in front of the beak; laterals almost wanting, blurred; anterior scars impressed; beak cavities deep, compressed; nacre bluish-white, purplish or salmon, thickened in front.

Length 75, height 44, diam. 30 mm.

Length 70, height 47, diam. 32 mm.

Length 50, height 30, diam. 19 mm.

Lower St. Lawrence drainage; southward to North Carolina.

Type locality, Delaware and Schuylkill Rivers.

Monodonta undulata SAY, Nich. Enc., 1817, pl. III, fig. 3.

Alasmidonta undulata SAY, Jl. Acad. N. Sci. Phila., I, 1818, p. 460.—SIMPSON, Syn., 1900, p. 667.

Alasmodonta undulata SAY, Nich. Enc., 1819, pl. III, fig. 3.

Alasmodon undulata SWAINSON, Tr. on Mal., 1840, p. 288, fig. 61.—GOULD, Inv. Mass., 1841, p. 115, fig. 76.—DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 198, pl. XV, fig. 227.

Margarita (Margaritana) undulata LEA, Syn., 1836, p. 44; 1838, p. 27.

Unio undulata HANLEY, Test. Moll., 1842, p. 211.

Margaritana undulata KUSTER, Conch. Cab. Unio, 1862, p. 298, pl. XCIX, fig. 4.—GOULD, Inv. Mass., 1870, p. 176, fig. 478.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 92, fig. 190.

Margaron (Margaritana) undulata LEA, Syn., 1852, p. 42; 1870, p. 68.
Mya undulata WOOD, Ind. Test. Rev., 1856, p. 199, pl. 1, suppl., fig. 5.
Baphia undulata H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 499.
Unio undulatus CATLOW and REEVE, Conch. Nom., 1845, p. 65.
Strophitus undulatus STIMPSON, Shells of New Eng., 1851, p. 15.
? Unio glabratus SOWERBY, Rec. and Foss. Shells, XVI, 1823, fig.
Alasmodonta sculptilis SAY, N. Harmony Diss., II, 1829, p. 339.
Strophitus sculptilis STIMPSON, Shells of New Eng., 1851, p. 15.
Unio hians VALENCIENNES, Rec. Obs. Zool., II, 1833, p. 235, pl. LIV, figs. *2a, 2b*.
Uniopsis radiata SWAINSON, Tr. on Mal., 1840, p. 289, fig. 62.
Uniopsis mytiloides SWAINSON, Tr. on Mal., 1840, p. 382, fig. 62.
? Unio swainsoni SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVI, fig. 396.
Margaron (Margaritana) swainsoni LEA, Syn., 1870, p. 30.

A characteristic species of the Atlantic drainage. Usually the shell is solid and shining, brightly rayed when young but becoming apparently a uniform brown or blackish when old, but showing rays when held up to the light. The beak sculpture is very coarse and there are sometimes radial wrinkles running across it. The teeth are stronger than in any other species, which I place in *Alasmidonta*. The nacre varies much in color and is decidedly thickened in front.

Subgenus PRESSODONTA Simpson, 1900.

Pressodonta SIMPSON, Syn., 1900, p. 667.

Shell decidedly rhomboid, surface generally painted with unbroken rays; beak sculpture slightly corrugated; teeth compressed.

Marsupium thick, smooth, pad-like.

Type, *Unio calceolus* Lea.

The names *Hemiodon* and *Hemidonta* were applied by Swainson to this group, but he used the first previously for a division of the Helicidæ and the second is merely feminine of the first. He also used the name *Hemidon,* but whether it was intended for the group of *Alasmidonta calceolus* or the subfamily *Alasmodontinæ,* I cannot determine.

Group of *Alasmidonta calceolus.*

Shell small, subsolid, rhomboid, inflated, rayed but not shining; beak sculpture varying from strong concentric bars to irregular corrugations, sometimes faintly doubly looped, and with fine radiating ridges in front and behind; pseudocardinals rather solid; laterals very faint; marsupium occupying the whole of the outer gills, thick, pad-like; inner gills wholly or partly free from the abdominal sac; mantle bordered with square, black spots.

ALASMIDONTA CALCEOLUS (Lea).

Shell rather small, convex to subinflated, usually decidedly rhomboid, somewhat inequilateral, subsolid; beaks neither full nor elevated, the sculpture varying from strong bars, which run parallel with the growth lines to irregular, often doubly looped, corrugations, generally with radial, raised threads in front and behind; posterior ridge usually high, rounded and ending in a rounded point behind at the base of the shell, rarely it ends just below the median line; surface with uneven growth lines; epidermis dull ashy or ashy-green with wavy rays, sometimes the dark rays occupy most of the shell leaving narrow light rays between; left valve with a blurred tooth under the beak and a faint one in front; right valve with one tooth in front of the beak; laterals blurred, often almost wanting; nacre whitish, a little thicker in front.

Length 50, height 30, diam. 22 mm.

Length 36, height 22, diam. 15 mm.

Upper Mississippi drainage; Ohio, Cumberland, and Tennessee rivers; Lower and Middle St. Lawrence systems.

Type locality, Ohio.

Unio calceolus LEA, Tr. Am. Phil. Soc., III, 1830, p. 265, pl. IV, fig. 1; Obs., I, 1834, p. 7, pl IV, fig. 1.—CHENU, Ill. Conch., 1858, pl. VIII, figs. 2, *2a*, *2c*.—KUSTER, Conch. Cab. Unio, 1861, p. 187, pl. LIX, fig. 3.

Strophitus calceolus CONRAD, Pr. Ac. N. Sci., Phila., VI, 1853, p. 262.

Unio calceola DESHAYES, An. sans Vert., 2d ed., VI, 1835, p. 546.—HANLEY, Biv. Shells, 1843, p. 212, pl. XXII, fig. 29.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVIII, fig. 410.

Margarita (Margaritana) calceola LEA, Syn., 1836, p. 45; 1838, p. 27.

Margaron (Margaritana) calceola LEA, Syn., 1852, p. 43; 1870, p. 68.

Margaritana calceola KUSTER, Conch. Cab. Unio, 1862, p. 299, pl. XCIX, fig. 6.

Baphia calceola H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 500.

Alasmidonta calceola SIMPSON, Syn., 1900, p. 668.

Alasmodonta truncata CONRAD, New F. W. Shells, 1834, p. 73.

Margarita (Margaritana) deltoidea LEA, Syn., 1836, p. 44; 1838, p. 27.

Margaritana deltoidea LEA, Tr. Am. Phil. Soc., VI, 1838, p. 43, pl. XIII, fig. 38; Obs., II, 1838, p. 43, pl. XIII, fig. 38.—CHENU, Man., 1859, II, p. 144, fig. 711.—KUSTER, Conch. Cab., 1862, p. 299, pl. XCIX, fig. 5.

Unio deltoidea HANLEY, Biv. Shells, 1843, p. 211, pl. XXII, fig. 50.

Margaron (Margaritana) deltoidea LEA, Syn., 1852, p. 42; 1870, p. 67.

Strophitus deltoidea CONRAD, Pr. Ac. N. Sci., Phila., VI, 1853, p. 263.

Baphia deltoidea H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 499.

Alasmodonta deltoidea BAKER, Moll. Chicago, Pt. 1, 1898, p. 63, pl. VI, fig. 2; VII, fig. 4.

Unio deltoideus SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVI, fig. 395.

I cannot by any possibility separate this from Lea's *Margaritana deltoidea*. Lea says that the *deltoidea* is smaller, more triangular and flattened and that the undulations of the beaks are unbroken. There seems to be every possible variation between these extremes of beak sculpture, sometimes occurring in a lot from the same locality; the larger shells have both kinds of sculpture and while the form is usually decidedly rhomboid, there occurs every variation to specimens that are nearly elliptical.

ALASMIDONTA MINOR (Lea).

Shell small, rhomboid, convex, somewhat inequilateral, with moderately full but not high beaks, their sculpture a few coarse ridges running parallel with the growth lines, with radial threads in front of and behind them; posterior ridge low or moderate, rounded, ending behind in a widely rounded point at the base; surface with uneven growth lines; epidermis greenish-yellow with broad and narrow wavy green rays, the yellow spaces between them often narrower than the rays, the whole lusterless; left valve with a strong, double or triple tooth; right valve with one strong tooth under the beak; laterals faint and blurred; nacre bluish-white, sometimes dirty straw-colored, a little thicker in front.

Length 39, height 25, diam. 14 mm.

Length 37, height 22, diam. 15 mm.

Tennessee and Cumberland River systems.

Type locality, North Carolina.

Margaritana minor LEA, Pr. Am. Phil. Soc., IV, 1845, p. 166; Tr. Am. Phil. Soc., X, 1848, p. 82, pl. VIII, fig. 26; Obs., IV, 1848, p. 56, pl. VIII, fig. 26.—CHENU, Man., 1859, II, p. 144, fig. 713.

Strophitus minor CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 263.

Margaron (Margaritana) minor, LEA, Syn., 1852, p. 42; 1870, p. 67.

Baphia minor H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 490.

Alasmidonta minor SIMPSON, Syn., 1900, p. 668.

I think it more than likely that this will prove only a mere variety or local race of *A. calceolus,* when a sufficient amount of material is examined. It seems to be quite rare, and I have never been able to see more than a few shells from the Tennessee and Cumberland systems. The posterior ridge is a little lower and more rounded than in *A. calceolus* and the posterior point is more widely rounded; the epidermis is a little differently colored, the lighter part of it being yellowish instead of ashy.

Group of *Alasmidonta heterodon.*

Shell small, rather thin, rhomboid; beak sculpture very strong, consisting of concentric ridges or irregular corrugations, often slightly doubly looped and swollen on the well-developed posterior ridge; surface rayed; pseudocardinals compressed, reflexed; laterals single, double, or triple in each valve.

Animal with branchial opening having a few coarse papillæ; anal opening smooth, or with very fine crenulations.

ALASMIDONTA HETERODON (Lea).

Shell small, long rhomboid, inequilateral, convex, thin to subsolid; beaks low but rather full, their sculpture consisting of a few strong, corrugated ridges, which run nearly parallel with the growth lines, with radiating threads in front of and behind them; posterior ridge well developed, narrowly rounded or subangular, ending in a rather sharp point a little above the base; surface with uneven growth lines, dirty greenish, faintly rayed, dull colored; left valve with two pseudocardinals, the hinder somewhat broken and compressed; right valve with one compressed pseudocardinal; laterals imperfect, lamellar, one or two, sometimes three in each valve; nacre bluish-white.

Length 36, height 18, diam. 12 mm.

Northern New England to Virginia.

Type locality Schuylkill River and Derby Creek, Pa.

Unio heterodon LEA, Tr. Am. Phil. Soc., III, 1830, p. 428, pl. VIII, fig. 11; Obs., I, 1834, p. 42, pl. VIII, fig. 11.—CONRAD, Monog., X, 1838, p. 90, pl. XLIX, fig. 3.—HANLEY, Biv. Shells, 1843, p. 183, pl. XXI, fig. 42.—CHENU, Ill. Conch., 1858, pl. XVI, figs. 2, *2a*, *2b*.—KUSTER, Conch. Cab., 1861, p. 192, pl. LXI, fig. 2.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXV, fig. 184.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 91, fig. 188.

Margarita (Unio) heterodon LEA, Syn., 1836, p. 18; 1838, p. 16.

Margaron (Unio) heterodon LEA, Syn., 1852, p. 24; 1870, p. 36.

Alasmidonta heterodon SIMPSON, Syn., 1900, p. 669.

This shell closely resembles specimens of *A. calceolus*, but is more delicate and elongated, and is generally more compressed. The pseudocardinals are often quite imperfect and generally a little reflexed; the laterals are lamellar and not perfectly developed, often varying in number.

ALASMIDONTA DIVERSA (Conrad).

Shell rhomboid, considerably inflated, thin, but thicker before, especially at the base, inequilateral; beaks moderately full, their sculpture not seen; posterior ridge well developed, ending in a rounded point at the base of the shell; epidermis yellowish-olive, clouded with dark brown; rays obsolete or wanting; left valve with a three-parted, compressed pseudocardinal; right valve with one compressed pseudocardinal; laterals double in the right valve and single in the left; nacre greenish or wax-colored, dirty white towards the anterior base.

Length 38, height 24, diam. 18 mm.

Type locality, Shoal Creek, North Alabama.

Unio diversus CONRAD, Am. Jl. Sci., XXI, 1856, p. 172 (fig. in outline).

Alasmidonta diversa SIMPSON, Syn., 1900, p. 669.

Conrad has only given a couple of outline figures of this shell and I have never seen it. He states that it bears a remarkable

resemblance to *Unio heterodon*. It is however more regularly rhomboid, higher, more inflated than that species and differently colored.

Group of *Alasmidonta collina*.

Shell rhomboid, subsolid, with beak sculpture consisting of strong, concentric bars, sometimes slightly doubly looped, and swollen on the low, posterior ridge; often with one or more small spines on the disk in front of the posterior ridge; epidermis brown, rayless or feebly rayed; rest marks well defined; teeth rather compressed; laterals lamellar.

Animal unknown.

ALASMIDONTA COLLINA (Conrad).

Shell rhomboid, convex, subsolid, inequilateral, with moderately full, high beaks, their sculpture a number of strong, slightly double-looped ridges; posterior ridge full, rounded, ending behind at the base of the shell in a rounded point; growth lines elevated into slight, concentric ridges; besides this sculpture there are generally one or two sharp, prominent tubercles or spines placed on a line running from the beaks to a little behind the central base, though these are sometimes entirely wanting; epidermis smoky, greenish-brown, showing the rest marks, subshining; left valve with two subcompressed, irregular pseudocardinals and two straight, delicate laterals; right valve with a compressed pseudocardinal, with a vestigial one in front of and behind it, with one lateral; beak cavities shallow; nacre bluish-white, slightly thicker at the anterior base.

Length 35, height 22, diam. without the spines 13, diameter over all 15 mm.

North Carolina and Virginia.

Type locality, North River, Va.

Unio collinus CONRAD, Monog., VIII, 1837, p. 65, pl. XXXVI, fig. 2; XII, 1840, p. 109, pl. IX, fig. 3.—HANLEY, Biv. Shells, 1856, p. 382, pl. XX, fig. 57.—KUSTER, Conch. Cab. Unio, 1861, p. 188, pl. LIX, fig. 5.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLIX, fig. 263.

Margaron (Unio) collinus LEA, Syn., 1852, p. 23; 1870, p. 35
Alasmidonta collina SIMPSON, Syn., 1900, p. 669.

I have never seen the animal of this species and cannot be certain as to its systematic position. The form of the shell, and the beak sculpture, are like those of forms of *Alasmidonta*. The teeth, though nearly or quite perfect, are more like those of that genus than of any Unios I know of. They are only a little better developed than those of *A. heterodon*.

Group of *Alasmidonta holstonia*.

Shell subsolid, beak sculpture rather strong, decidedly doubly looped, surface brownish, slightly rayed; pseudocardinals delicate; laterals nearly or quite wanting. Animal like that of *A. calceolus*.

ALASMIDONTA HOLSTONIA (Lea).

Shell usually long rhomboid, rarely elliptical, subsolid, convex, inequilateral; beaks full but not high, their sculpture strong, doubly-looped ridges, the hinder loop narrow and angular; posterior ridge rounded or disposed to be double, ending behind in a rounded point or feeble biangulation at the base; surface with irregular growth lines; epidermis dull greenish-brown or yellow-brown, rarely with slight rays; left valve with two low, compressed teeth in front of the beak; right valve with a single, compressed anterior tooth; laterals nearly or quite obsolete; nacre bluish-white.

Length 50, height 29, diam. 19 mm.

Tennessee River system; headwaters of the Coosa River. Type locality, Holston River.

Margaritana holstonia LEA, Tr. Am. Phil. Soc., VI, 1838, p. 42, pl. XIII, fig. 37; Obs., II, 1838, p. 42, pl. XIII, fig. 37.

Margarita (Margaritana) holstonia LEA, Syn., 1836, p. 46; 1838, p. 28.

Margaron (Margaritana) holstonia LEA, Syn., 1852, p. 44; 1870, p. 70.

Strophitus holstonia CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 263.

Baphia holstonia H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 499.

Alasmidonta holstonia SIMPSON, Syn., 1900, p. 670.

Unio holstonianus HANLEY, Biv. Shells, 1843, p. 213, pl. XXII, fig. 44.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVI, fig. 398.

Margaritana holstoniana KUSTER, Conch. Cab. Unio, 1862, p. 302, pl. c, fig. 4.

? Unio striatus SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVIII, fig. 407.

A small species without any striking characters. It looks so much like a member of the *vanuxemensis* group of *Lampsilis* that it has often deceived experts and has been sent out as *Unio litus, U. proprius,* etc., but a glance at its interior will always show the lack of laterals, which are present in the other species.

Group of *Alasmidonta georgiana.*

Shell rhomboid, slightly rayed, with strong beak sculpture, the ridges parallel with the growth lines; pseudocardinals single, in each valve; laterals wanting.

ALASMIDONTA GEORGIANA (Lea).

Shell elliptical, convex, rather thin, inequilateral, beaks almost compressed, not elevated but pointed, their sculpture consisting of a few rather coarse ridges, which run nearly parallel to the growth lines; posterior ridge full, rounded, ending behind in a rounded point below the median line; growth lines irregular; epidermis dirty yellowish-green with a few narrow rays behind or rayless; left valve with a low, smooth, compressed tooth just in front of the beak; right valve with a single compressed tooth placed well forward; laterals reduced to mere vestiges; nacre bluish or purplish, dirty and lurid.

Length 53, height 30, diam. 17 mm.

Type locality, Etowah River, Georgia. Also Tennessee.

Margaritana etowahensis LEA, Pr. Ac. Nat. Sci. Phila., II, 1858, p. 138; Jl. Ac. Nat. Sci. Phila., IV, 1859, p. 227, pl. XXXI, fig. 110; Obs., VII, 1859, p. 45, pl. XXXI, fig. 110.

Margaritana (Alasmodonta) etowahensis CLESSIN, Conch. Cab. Ano., 1875, p. 270, pl. LXXXI, figs. 1, 2.

Margaritana etowahensis PATEL, Conch. Sam., III, 1890, p. 173.

Margaritana georgiana LEA, Pr. Ac. Nat. Sci. Phila., III, 1859, p. 280.

Margaron (Margaritana) georgiana LEA, Syn., 1870, p. 68.

Alasmidonta georgiana SIMPSON, Syn., 1900, p. 670.

Alasmodonta impressa ANTHONY, Am. Jl. Conch., I, 1865, p. 157, pl. XII, fig. 4.

Lea has three specimens in his collection, which he calls *Margaritana georgiana*. The type and a young shell are no doubt the same thing, but the best preserved shell is, I feel sure, a young *Symphynota quadrata*. It has decidedly and sharply doubly-looped beak sculpture and better developed teeth than the others. The two specimens of *georgiana* have badly eroded beaks, but by a careful examination with a glass I can make out that their sculpture is coarse, nearly straight ridges. Their teeth consist of a single rounded knob in each valve; the laterals are wanting.

Subgenus RUGIFERA Simpson, 1900.

Rugifera SIMPSON, Syn., 1900, p. 670.

Shell elongated, rhomboid, inflated, surface brilliantly painted with radiations, which often break into a dappled or splashed pattern of color; posterior slope slightly corrugated; teeth very imperfect; laterals wanting.

Animal with a thick, smooth, pad-like marsupium. Mantle with square spots behind.

Type, *Alasmodonta marginata* Say.

ALASMIDONTA MARGINATA Say.

Shell medium to rather large, long rhomboid, nearly or quite equilateral, subsolid to solid, subinflated; beaks very full, high, sculptured with a few strong corrugations, which show a tendency to be doubly looped; posterior ridge very high and angled, ending behind in a point at the base of the shell, behind

the ridge there is a decided oblique truncation and the truncated area is rather finely corrugated; growth lines uneven; epidermis smooth, shining, greenish, ashy or smoky-green with narrow yellowish rays and broken, clouded green ones; left valve with one small, compressed, sharp tooth in front of the beak; right valve with a small anterior tooth; laterals almost or quite wanting; beak cavities rather deep; nacre white or bluish, sometimes straw-color, rarely reddish or purple; prismatic border distinct.

Length 120, height 72, diam. 48 mm.

Length 109, height 58, diam. 45 mm.

Upper Mississippi drainage; Ohio, Cumberland, and Tennessee River systems; Michigan; Upper St. Lawrence drainage.

Type locality, Scioto River, Chillicothe, O.

Alasmodonta marginata SAY, Nich. Encyc., 1819, No. 1; Jl. Ac. Nat. Sci. Phila., I, 1819, p. 459.—RAFINESQUE, Ann. Gen. Sci. Brux., V, 1820, p. 317.

Margarita (Margaritana) marginata LEA, Syn., 1836, p. 43; 1838, p. 27.

Margaron (Margaritana) marginata LEA, Syn., 1852, p. 42; 1870, p. 67.

Margaritana marginata KUSTER, Conch. Cab. Unio, 1862, p. 297, pl. XCIX, fig. 3.

Alasmodonta marginata BAKER, Moll. Chicago, Pt. 1, 1898, p. 62, pl. IV, fig. 4; VII, fig. 7; XXII, fig. 3.

Margaritana marginata var. *truncata* B. H. WRIGHT, Naut., XI, 1898, p. 124.

Unio marginatus SOWERBY, Conch. Icon., XVI, 1866, pl. LI, fig. 267.

Alasmodonta truncata CONRAD, Pr. Ac. Nat. Sci. Phila., VI, 1853, p. 262.

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

In rare instances the beaks of this species are as near to or nearer to the posterior end than to the anterior. Occasionally the tooth in the left valve is divided and both are often a little

reflexed. I have seen old, solid shells, which seemed to have a rayless, nearly black or brown epidermis, but when held up to the light the rays could be seen.

ALASMIDONTA VARICOSA (Lamarck).

Shell of medium size, thin, long rhomboid, with moderately full, slightly elevated beaks, their sculpture consisting of heavy ridges that run nearly parallel to the growth lines; posterior ridge high, generally double, ending in a biangulation near the base of the shell, the greatest inflation being along this ridge; posterior slope slightly corrugated, remainder of the surface irregularly marked with growth striæ; epidermis dirty yellowish-green with feeble, sometimes clouded, rays; left valve with a faint tooth under or a little in front of the beak; right valve with an anterior tooth; laterals wanting; nacre bluish, lurid in the cavities with a distinct, narrow prismatic border.

Length 54, height 32, diam. 20 mm.

Lower St. Lawrence; southward in streams draining into the Atlantic to South Carolina.

Type locality, Schuylkill River near Philadelphia, Pa.

Unio varicosa LAMARCK, An. sans Vert., VI, 1819, p. 78.

Alasmidonta marginata SIMPSON, Syn., 1900, p. 670.

Alasmodon marginata GOULD, Inv. Mass., 1841, p. 116, fig. 77.—DE KAY, Zool. of N. Y., Pt. v. 1843, p. 196, pl. XIV, fig. 225.

Unio marginata HANLEY, Biv. Shells, 1843, p. 211, pl. XXI, fig. 23.

Anodonta marginata C. B. ADAMS, Thompson's Hist., 1842, p. 164.

Baphia marginata H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 500.

Margaritana marginata GOULD, Inv. of Mass., 1870, p. 177, fig. 479.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 93, fig. 191.

Unio marginatus CATLOW and REEVE, Conch. Nom., 1845, p. 61.

Unio cariosa LAMARCK, An. sans Vert., VI, 1819, p. 80.

Alasmodon corrugata De Kay, Zool. of N. Y., Pt. 5, 1843, p. 198, pl. xxiv, fig. 259.

Mya rugulosa Wood, Ind. Test., 3d ed., 1856, p. 199, pl. 1, supp. fig. 7.

Certainly distinct from the heavier, larger, more inflated and truncated form found in western rivers. The teeth are less developed and it is biangulate behind. Specimens occasionally grow somewhat larger than the measurements given above.

Alasmidonta raveneliana (Lea).

Shell oblong, subrhomboid, scarcely inflated, thin to subsolid, inequilateral; beaks moderately full, slightly elevated, their sculpture apparently a few strong, somewhat doubly-looped bars; posterior ridge double, ending behind at or near the base in a biangulation; posterior slope having fine corrugated, radiating wrinkles; surface otherwise generally smooth or marked with a few uneven growth lines; epidermis pale yellowish-green to brown, faintly rayed, the rays sometimes broken into blotches; each valve has a single, low, smooth tooth near the beaks; laterals almost or quite obsolete; nacre dirty greenish, whitish or purplish, lurid; prismatic border distinct.

Length 76, height 39, diam. 23 mm.

Length 75, height 42, diam. 37 mm.

Tennessee and Cumberland River Systems.

Type locality, French Broad and Swannanoa rivers, N. C.

Margaritana raveneliana Lea, Tr. Am. Phil. Soc., V, 1834, p. 106, pl. xvii, fig. 50; Obs., I, 1834, p. 218, pl. xvii, fig. 50.—Kuster, Conch. Cab. Unio, 1862, p. 207, pl. xcix, fig. 2.

Alasmodonta raveneliana Ferussac, Guer. Mag., 1835, p. 26.

Margarita (Margaritana) raveneliana Lea, Syn., 1836, p. 44; 1838, p. 27.

Margaron (Margaritana) raveneliana Lea, Syn., 1852, p. 42; 1870, p. 68.

Baphia raveneliana H. and A. Adams, Gen. Rec. Moll., II, 1857, p. 500.

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

Strophitus ravenelianus CONRAD, Pr. Ac. Nat. Sci. Phila., VI 1853, p. 263.

Unio swananoensis HANLEY, Test. Moll., 1842, p. 211; Biv. Shells, 1843, p. 211, pl. XXIII, fig. 39.

Lea's material is in almost unrecognizable condition. But the National Museum possesses fine sets of the species from Asheville, North Carolina, and from the North and South Forks of the Cumberland River. None of these specimens have perfect beaks, but one or two, which are less eroded than the rest, seem to indicate that their sculpture consists of strong, wavy, slightly doubly-looped ridges. Old shells appear to be uniform brown, but show the rays when held up to the light. It is a larger, solider, more elongated shell than what I have described as *A. varicosa* and is less solid and inflated, less truncated behind and more biangulate than *marginata*.

Subgenus BULLELLA Simpson, 1900.

Bullella SIMPSON, Syn., 1900, p. 672.

Shell thin, greatly inflated, somewhat triangular, with a high, sharp posterior ridge; beaks very full, having exceedingly strong, concentric sculpture, extending well on to the disk; pseudocardinals reflexed, compressed.

Animal with the gills large, nearly semicircular below, inner the larger, united the whole length to the abdominal sac; mantle border with square spots.

Type, *Margaritana arcula* Lea.

ALASMIDONTA ARCULA (Lea).

Shell subtriangular, thin, greatly inflated, slightly inequilateral, with very full, high beaks, their sculpture consisting of a number of strong ridges running nearly parallel with the growth lines. These extend well out on to the disk and they are crossed by fine, wrinkled, radiating threads. In front of and behind the regular sculpture there are radiating liræ. Posterior ridge very high, angled, ending behind in a point near the base; posterior slope truncated, with a low, radial ridge; anterior end much narrowed, rounded, the beaks rising

high above it; surface with strong, uneven growth lines, covered with a dull epidermis, which is greenish and slightly rayed in young shells; in the adult state it is apparently black, but the rays can be seen through it when it is held up to the light; hinge line sinuous; left valve with a long, compressed, imperfect tooth at the beak, which is partially divided; right valve with one compressed, triangular tooth; laterals almost obsolete; beak cavities very deep; nacre bluish, bluish-white and thickened in front.

Length 80, height 60, diam. 50 mm.

Altamaha River, Georgia.

Type locality, Altamaha River, Liberty Co., Ga.

Margarita (Margaritana) arcula LEA, Syn., 1836, p. 43; 1838, p. 27.

Margaritana arcula LEA, Tr. Am. Phil. Soc., VI, 1838, p. 71, pl. XXII, fig. 69; Obs., II, 1838, p. 71, pl. XXII, fig. 69.—CHENU, Man., 1859, II, p. 144, fig. 712.

Unio arcula HANLEY, Biv. Shells, 1843, p. 210, pl. XXII, fig. 49. —SOWERBY, Conch. Icon., XVI, 1866, pl. XLVIII, fig. 259.

Margaron (Margaritana) arcula LEA, Syn., 1852, p. 42; 1870, p. 67.

Alasmodonta arcula CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 262.

Baphia arcula H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 500.

Margaritana (Alasmodonta) arcula CLESSIN, Conch. Cab. Ano., 1876, p. 272, pl. LXXXIII, figs. 7, 8.

Alasmidonta arcula SIMPSON, Syn., 1900, p. 672.

A remarkable form, which cannot be mistaken for any other. If the character of the longitudinally folded gravid outer gills is constant the species should have generic rank, but I am not so sure that it is. *A. triangulata* seems to stand between it and the other Alasmidontas.

ALASMIDONTA TRIANGULATA (Lea).

Shell short, subtriangular, inflated, rather thin, slightly inequilateral; beaks high and full, their sculpture a number of strong, concentric ridges with radial liræ in front of and be-

hind them; posterior ridge high and angled, ending behind in a point near the base; posterior slope somewhat truncated, having two or three low, radial ribs and a few feeble plications; surface rather smooth; epidermis tawny to greenish-brown, smoky, faintly rayed; left valve with one irregular tooth under the beak, with a vestigial one forward; right valve with a high, recurved anterior tooth; laterals almost obsolete; beak cavities deep; nacre bluish-white.

Length 40, height 27, diam. 24 mm.

South Carolina and Georgia.

Type locality, Upper Chattahoochee River; Columbus; Palato Creek, Ga.; Sawney's Creek, S. C.

Margaritana triangulata LEA, Pr. Ac. N. Sci. Phila., II, 1858, p. 138; Jl. Ac. N. Sci. Phila., IV, 1859, p. 228, pl. XXXII, fig. 111; Obs., VII, 1859, p. 46, pl. XXXII, fig. 111.—KUSTER, Conch. Cab. Unio, 1862, p. 303, pl. c, fig. 6.

Unio triangulata SOWERBY, Conch. Icon., XVI, 1868, pl. LXXX, fig. 414.

Margaron (Margaritana) triangulata LEA, Syn., 1870, p. 68.

Margaritana triangulatus PÆTEL, Conch. Sam., III, 1890, p. 174.

Alasmidonta triangulata SIMPSON, Syn., 1900, p. 672.

This species shows relationship to *A. arcula* by its inflation, its triangular form, beak sculpture and beaks and the somewhat sinuous hinge plate. But the hinge is heavier and more like that of the ordinary Alasmidontas than that of *arcula* and the epidermis is that of an *Alasmidonta*.

Unfigured and indeterminate species.

Margaritana etowahensis CONRAD, Pr. Ac. Nat. Sci. Phila., IV, 1849, p. 154.

Alasmodon (Decurambis) atropurpureum RAFINESQUE, Cont. Monog., 1831, p. 5.

Alasmodon(Decurambis)scriptum RAFINESQUE, Cont., Monog., 1831, p. 5.

Alasmodon (Lasmigona) viridis RAFINESQUE, Cont., Monog., 1831, p. 5.

Alasmodon (Sulcataria) papyraceum RAFINESQUE, Cont. Monog., 1831, p. 5.

Alasmodon (Sulcataria) badium RAFINESQUE, Cont. Monog., 1831, p. 5.

Alasmodon (Amblamodon) hians RAFINESQUE, Cont. Monog., 1831, p. 5.

Genus MARGARITANA Schumacher, 1817.

Baphiæ MEUSCHEN, Mus. Gevers, 1787, p. 472.

Unio RETZIUS, part, Diss. Hist. Nov. Test. Gen., 1788, p. 16.

Unio OKEN, Lehrbuch der Nat., 1815, p. 236.

Margaritana SCHUMACHER, Essai Nouv. Syst., 1817, p. 137.

Damalis (LEACH manuscript) GRAY, Pr. Zool. Soc. Lond., 1847, p. 196.

Baphia H. and A. ADAMS, Gen. Rec. Moll., II, 1858, p. 499.

Shell elongated, usually arcuate, rounded in front, almost lacking a posterior ridge; beaks rather low, the sculpture consisting of a few coarse, parallel ridges, which follow the growth lines; epidermis concentrically striate, brownish or blackish; hinge teeth generally imperfect or not fully developed; two more or less perfect pseudocardinals in the left valve, and one in the right, often reduced to mere tubercles; behind these the hinge plate is narrow and rounded for some distance; laterals short, usually imperfect or wholly wanting; cavity of the beaks rather shallow; muscle scars large, those of the anterior roughened, posterior elliptical; nacre generally more or less covered inside the pallial line with small muscle scars.

Animal with very long gills, inner wider in front, free for the greater part of their length from the abdominal sac, the two pairs united to their posterior ends, which project backward for some distance, unconnected with the mantle; palpi very large, falcate, united half way posteriorly; branchial opening having crowded, often arborescent, papillæ arranged in folds; anal opening smooth or crenulate; superanal opening

not closed below; marsupium occupying the entire outer gills. Foot and abdomen small; whole animal dark colored.

Type, *Mya margaritifera* Linnæus.

A homogeneous group having a circumboreal distribution with two species in the warmer temperate region of the United States and one, singularly isolated, in the Oriental Tropics. Most of the species have shells with defective hinge teeth and in none of them are they very strongly developed. All have simple, more or less arcuate, shells with dull colored, thick, dark epidermis, and gills that are free from the mantle at the posterior end. I have examined a great many animals of the *Margaritana margaritifera* taken at different seasons and in many localities but have never found one gravid. Von Wahl states that the marsupium occupies the entire outer gills, and I have been informed that specimens have been found with a few embryos in the inner gills also.

The name *Baphiæ* Meuschen has precedence, but was never described; it was applied to a miscellaneous lot of bivalves, and is in the plural number. Retzius's first species in *Unio,* the type of a section without laterals, is the *U. margaritifer,* but in 1792 Bruguière in Choix de Mémoires, I, p. 106, fully and carefully redefined the genus *Unio,* restricting it to species with cardinal and lateral teeth.

Ortmann, (Naut. XXV, 1911, p. 6), separates this genus from the *Unionidæ* and proposes the family *Margaritanidæ* for its reception. "The chief differences of this family are found in the incomplete gill-diaphragm; in the entire lack of a tendency to approach or to unite the mantle margins to form siphons; in the structure of the gills, which lack regular septa running parallel to the gill-filaments, and, consequently, in the lack of the well-defined water-tubes (ovisacs in the female); in the marsupium being formed by all four gills; and in the small size and globular shape of the glochidium, without true hooks." But Lefevre and Curtis, (Bull. Bur. Fish., XXX, 1912, p. 118), consider this "a procedure of doubtful wisdom."

KEY TO SPECIES OF MARGARITANA.

Posterior end of the shell corrugated. *M. hembeli.*
Shell not corrugated.
Pseudocardinals strong.
Laterals generally wanting. *M. margaritifera.*
Laterals present.
Shell large, solid. *M. crassa.*
Shell rather small, thin behind. *M. laosensis.*
Pseudocardinals feeble.
Shell long, not compressed, arcuate. *M. monodonta.*
Shell rather short, compressed. *M. decumbens.*

Group of *Margaritana margaritifera.*

Shell having irregular, concentric growth lines, but without plicate or corrugated sculpture.

MARGARITANA MARGARITIFERA (Linnæus).

Shell large, much elongated, usually arcuate, rounded before and somewhat so behind, rather solid, inequilateral, not inflated; beaks low, not inflated, their sculpture consisting of longitudinal ridges, which are sometimes a little broken; posterior ridge moderate or low, often having a wide, radial depression above it, and ending below the median line, sometimes in a point, in old shells in a rounded termination; surface with rude growth lines; epidermis thick, blackish or brownish, often subshining; left valve with two stumpy pseudocardinals; right valve with one pseudocardinal; laterals generally wanting; beak cavities not deep; muscle scars impressed, the anterior rough, the posterior elliptical; nacre lurid, bluish-white, whitish, purplish or purple, generally showing pits where the mantle is attached, often having dark blotches.

Length 152, height 65, diam. 40 mm.
Length 122, height 60, diam. 38 mm.
Length 110, height 54, diam. 35 mm.

All Europe except the southernmost portion; northern Asia; Japan; northern North America; Iceland. Its southern limit

seems to be about north latitude 40°. It appears to be entirely circumboreal, except that, so far as is known, it is missing in the central part of the North American continent. Wetherby has suggested that it may have been destroyed in this region by the ice of the glacial epoch. But, see Walker, Pr. Mal. Soc. London, IX, 1910, p. 126. It is found in the upper Missouri and in Canada East, New York and the New England States.

Mya margaritifera LISTER, Hist. Anim. Ang. App., 1685, pl. 1, fig. 1; Hist. Conch., 1685, pl. CXLIX, fig. 4.—LINNÆUS, Systema. Nat., 10th ed., I, 1758, p. 671.—DA COSTA, Hist. Nat. Brit., 1778, p. 225, pl. XV, fig. 33.—KNORR, Vergn., IV, 1769, pl. XXV, fig. 2.—PENNANT, Brit. Zool., IV, 1777, pl. XLIII, fig. 18.—DA COSTA, Hist. Nat. Brit., 1778, p. 225, pl. XV, fig. 3.—SCHRÖTER, Fluss Conch., 1779, p. 168, pl. IV, fig. 1.—DONOVAN, Brit. Shells, III, 1801, pl. LXXIII.—WOOD, Gen. Conch., I, 1815, p. 107, pl. XXIII, figs. 1-3; Index Test., 1825, p. 12, pl. II, fig. 30.—CHENU, Bib. Conch., 1st ser., I, 1845, p. 57, pl. XX, figs. 1, 2.—HANLEY (WOOD), Ind. Test., 3d ed., 1856, p. 16, pl. II, fig. 30.

Mya margaritifera testa ovali oblonga, etc.—CHEMNITZ, Conch. Cab., VI, 1782, p. 15, pl. 1, fig. 5.

Baphiæ margaritifera MEUSCHEN, Mus. Gevers, 1787, p. 472.

Unio margaritifera DRAPARNAUD, Hist. Moll. Fr., 1806, p. 132, pl. X, figs. 17-19; pl. XI, fig. 5?—C. PFEIFFER, Nat. Deutsch. Land und Suss. Moll., 1821, Pt. 1, p. 115, pl. V, fig. 11.

Margaritana margaritifera SCHUMACHER, Essai. Nouv. Syst., I, 1817, p. 124, pl. X, fig. 4.—TROSCHEL, Arch. für Naturg., XIII, pl. 1, 1847, p. 270, pl. IV, fig. 1.—MOQUIN-TANDON, Hist. Moll. Fr., 1855, p. 623, pl. XXII, figs. 14-16.—KUSTER, Conch. Cab., 1856, p. 293, pl. XXXVIII; XXXIX, figs. 2-4.—CHENU, Manual, 1859, II, p. 144, fig. 710.—HARTMAN and MICHENER, Conch. Cest., 1874, p. 91, fig. 189.—CLESSIN, Deutsch. Ex. Moll., 1876, p. 449, fig. 293.—SIMPSON, Syn., 1900, p. 674.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 230, fig. 1.

Alasmodonta margaritifera CONRAD, New F. W. Shells, 1834, p. 72.

Margarita (Margaritana) margaritifera LEA, Syn., 1836, p. 45; 1838, p. 28.

Margaron (Margaritana) margaritifera LEA, Syn., 1852, p. 43; 1870, p. 69.

Baphia margaritifera H. and A. ADAMS, Gen. Rec. Moll., II, 1857, p. 499; III, pl. CXVII, figs. 2, 2a.

Unio margaritiferus RETZIUS, Dis. Hist. Nat., 1788, p. 16.—TURTON, Conch. Ins. Brit., 1822, p. 241, pl. XVI, fig. 1.—TURTON, Man. L. and F. W. Shells, 1831, p. 19, fig. 9.—FORBES and HANLEY, Hist. Brit. Moll., II, 1853, p. 146, pl. XXXVIII.—SOWERBY, Ill. Ind. Brit. Shells, 1859, pl. VII, No. 1.—TATE, L. and F. W. Moll. Brit., 1866, pl. III, fig. 15.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXIV, fig. 325.

Alasmodon margaritiferus BROWN, L. and F. W. Conch., 1836, p. 112, pl. XXI, fig. 13; pl. XXII, figs. 1-3.—BROWN, Ill. Recent Conch., 1844, p. 83, pls. XXX, figs. 1-4; XXXI, figs. 1, 2; XXXII, figs. 13-15.—TURTON, Man. L. and F. W. Shells, 1857, p. 277, pl. II, fig. 9.

Margaritana margaritiferus WESTERLUND, Faun. Pal., II, Pt. 7, 1890, p. 184.

Alasmodon margaritiferum FLEMING, Hist. Brit. Moll., 1828, p. 417.

Unio margaritifer var. *minor* ROSSMASSLER, Icon., Pt. 2, 1835, p. 19, pl. IX, fig. 129.

Unio margaritifer KUSTER, Conch. Cab., 1856, p. 130, pls. XXXVIII, XXXIX.—MOQUIN-TANDON, Moll. Terr. et Fluv. Fr., II, 1855, p. 566, pl. XLVII.—NORDENSKIÖLD and NYLANDER, Fin. Moll., 1856, p. 86, pl. VI, fig. 74.—DROUËT, Nay. Fr., II, 1857, p. 57, pl. I.—HESSLING, Perl. und Ihre Perlen, 1859, p. 86, pl. I.—REEVE, L. and F. W. Moll. Brit., 1863, p. 223, fig. 3.—L. ADAMS, Coll. Man., 1884, p. 19, pl. I, fig. 12.

Unio (Margaritana) margaritifer SCHRENCK, Reis. and F. im Amur-Lande, II, 1867? p. 700.

Unio elongata LAMARCK, An sans Vert., VI, 1819, p. 70.

Damaris elongata LEACH, Syn. Moll. Gt. Brit., 1852, p .322.

Margaritana clongata LOCARD, Coq. de Fr., 1893, p. 149, fig. 162.

Unio clongatus SOWERBY, Conch. Icon., XVI, 1868, pl. LXXVI, fig. 397.

Alasmodonta arcuata BARNES, Am. Jl. Sci., VI, 1823, p. 277, pl. XII, fig. 20.—C. B. ADAMS, Thompson's Hist. of Vermont, 1842, p. 165, fig.; F. W. and L. S. of Vt., 1842, p. 165, fig.

Mya arcuata EATON, Zool. Text Book, 1826, p. 222.

Alasmodon arcuata GOULD, Inv. of Mass., 1841, p. 113, fig. 75. —DE KAY, Zool. of N. Y., Pt. 5, 1843, p. 197, pl. XIV, fig. 224.

Margaritana arcuata KUSTER, Conch. Cab., 1856, p. 293, pl. XXXIX, fig. 1.—GOULD, Inv. of Mass., 1870, p. 174, fig. 477.

Unio sinuata C. PFEIFFER, Nat. Deutsch. L. and S. W. Moll., Pt. 2, 1825, p. 33, pl. VII, fig. 4.

Unio roissyi MICHAUD, Comp. Hist. Moll. Fr., 1831, p. 112, pl. XVI, fig. 28.

Margaritana roissyi WESTERLUND, Faun. Pal., II, Pt. 7, 1890, p. 186.

Unio tristis MORELET, Moll. Portugal, 1845, p. 107, pl. XIII, fig. 2.

Margarita (Unio) crassissimus LEA, Syn., 1836, p. 40; 1838, p. 26.

Unio (Alasmodonta) dahuricus MIDDENDORFF, Bull. Phys. Math. Ac. St. Petersb., IX, 1850, p. ?; Sib. Reise, II, 1851, p. 275, pl. XXVI, figs. 3-5.

Unio dahuricus MIDDENDORFF, L. and S. Moll. Sib., 1859, p. 26.

Unio (Margaritana) dahuricus SCHRENCK, Reis. und Forsh. Amur-Lande, II, 1867, p. 699.

Margaritana dahurica KOBELT, Faun. Jap. Ext., 1879, p. 143, pl. XIII, figs. 1, 2.

Alasmodon falcata GOULD, Pr. Boston Soc. Nat. Hist., III, 1850, p. 294.—U. S. Expl. Exp., XII, 1852, p. 433, figs. 545, 545*a*, 545 *b*.

Unio falcatus SOWERBY, Conch. Icon., XVI, 1868, pl. LXXV, fig. 390.

Margaritana margaritifera falcata DALL, Alaska, XIII, 1905, p. 132.—HANNIBAL, Pr. Mal. Soc. London, X, 1912, p. 122.

Unio (Alasmodonta) complanatus MIDDENDORFF, Sib. Reise, II, 1851, Pt. 1, p. 273, pl. XXVII, figs. 1-6.

Margaritana complanata WESTERLUND, Faun. Pal., II, Pt. 7, 1890, p. 187.

Unio mongolicus MIDDENDORFF, Sib. Reise, II, 1851, p. 277, pl. XXVII, figs. 7, 8.

Alasmodon yubaensis TRASK, Pr. Cal. Acad. Sci., I, 1855, p. 30.

? Margaritana raveneliana CHENU, Man., 1859, II, p. 144, fig. 714.

This species has the widest distribution of any Naiad in the world. It is found throughout Europe excepting, perhaps, the extreme southern portion, in Northern Asia, Japan, Western North America south to below the fortieth degree of latitude and east of the Rocky Mountains in the upper Missouri River. It seems to be missing in the North Central part of North America, but is abundant in Eastern Canada, New York, Pennsylvania and New England. I have examined extensive series of this shell, including the Lea, the Jeffreys and the general collections of the National Museum, some thousands in all, and I am unable to separate the species into satisfactory varieties. Usually the laterals are nearly or quite wanting in adult specimens; but occasionally they are quite well developed and I have seen full grown shells from Massachusetts, the Western United States, Japan and Europe with very fair laterals. In the young shells they are often developed. In localities where food is abundant and conditions are favorable the shells are large, clean, comparatively high and straight, the base being full, and this development has received names in Europe, but it occurs throughout the range of the species. Other specimens, which have not had abundant food or favorable environment, are small, stunted and decidedly arcuate. Old shells often become arcuate, as is the case among many Naiades. Among the shells of the Western United States the nacre is often deep purple or sometimes salmon red. I

have never seen this kind of nacre in specimens from other parts of the area of distribution of the species, but I do not think such a variation worthy of a varietal name.

MARGARITANA CRASSA (Retzius).

Shell large, solid, arcuate, sometimes subrhomboid, often rounded in front and behind, inequilateral, not inflated, beaks moderately elevated but not full; surface with irregular growth lines; epidermis blackish in old shells, brownish-green or reddish-brown in younger ones, dull; left valve with one or two strong, irregular, ragged pseudocardinals and two, sometimes three remote, rather small laterals; right valve with a single pseudocardinal, sometimes with a vestigial tooth behind it, and one lateral; beak cavities moderately deep; muscle scars large, impressed, the anterior rough, the posterior smooth and elliptical; pallial line deep, often rough; nacre white, showing pits occasionally of the muscular attachment of the mantle.

Length 137, height 67, diam. 40 mm.

Length 126, height 69, diam. 33 mm.

Length 134, height 63, diam. 38 mm.

Southern Europe; possibly into Asia Minor and southwest Siberia.

Mya testa crassa SCHRÖTER, Flussconch., 1779, p. 182, pl. II, fig. 2.

Margaritana crassa SIMPSON, Syn., 1900, p. 677.

Unio crassus RETZIUS, Diss. Hist. Nat., 1778, p. 17.

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

Unio auricularius SPEUGLER, Skriv. Nat. Siesk., III, 1792, p. 54.

Unio rugosa POIRET, Coq. Fluv., et Terr. de l'Aisne, 1801, p. 54.

Unio sinuata LAMARCK, An. sans Vert., VI, 1819, p. 70.—BLAINVILLE, Man., 1825, p. 539, pl. LXVII, fig. 3.—DESHAYES, Enc. Meth., II, 1827, p. 151, pl. CCXLVIII, fig. 1; II, 1830, p. 579, pl. CCXLVIII, fig. 1, *a*, *b*.

Unio (Potamida) sinuata SWAINSON, Tr. on Mal., 1840, p. 268.

Unio sinuatus ROSSMASSLER, Icon., III, 1836, p. 22, pl. XIII, fig. 195.—DUPUY, Hist. Moll. Fr., 1852, p. 630, pl. XXIII, fig. 7.—ROSSMASSLER, Icon., III, 1854, p. 38, pl. LXX, fig. 853*a*. —MOQUIN-TANDON, Moll. Terr. and Fluv. Fr., II, 1855, p. 567; III, pl. XLVIII, figs. 1-3.—DROUET, Nay. Fr., II, 1857, p. 61, pl. II.—SOWERBY, Conch. Icon., XVI, pl. LXII, fig. 311. —LOCARD, Coq. de Fr., 1893, p. 151, fig. 164.

Margaritana sinuata ORTMANN, Naut., XXV, 1911, p. 6.

? Unio litoralis C. PFEIFFER, Nat. Deutsch. L. and S. W. Moll., Pt. I, 1821, p. 117, pl. V, fig. 12.

Unio crassissimus HANLEY, Biv. Shells, 1843, p. 209, pl. XXIII, fig. 54.

Unio gargottæ PHILIPPI, Moll. Sic., 1836, p. 66.—ROSSMASSLER, Icon., VII and VIII, 1838, p. 26, pl. XXXV, fig. 493.

The shells of this species bear a strong superficial resemblance to those of *Margaritana margaritifera,* the latter having been repeatedly mistaken for this form. Usually the epidermis is duller and blacker than that of *margaritifera,* the beaks are a little fuller and higher, while the nacre is always white and the laterals are fairly well developed. The muscle scars are much alike in the two species, the anterior ones being rough and the posterior ones regularly elliptical, but in *M. crassa* the scars of attachment are few or often wanting, while they are generally present and often numerous in *margaritifera.*

The *M. crassa* appears to be confined to Southern Europe, and, judging by the scarcity of specimens in collections, it is a rather rare species. *Unio batavus,* with which it has been confounded, is a much smaller and rather more inflated species, which has its metropolis north of that of *M. crassa.*

Retzius' description is in Latin, and consists of ten words, and as he does not figure the species, it would be impossible to determine what he meant only for the fact that he refers to the Flussconchylien of Schröter (*Mya testa crassa,* p. 182, pl. II, fig. 2). Schröter's figure is not a very good one, but I can have no doubt that he had before him the large, heavy, black Naiad, with lateral teeth, found in southern Europe. In general it closely resembles the *M. margaritifera* externally,

but the epidermis is more dull black, the beaks are usually higher and more strongly developed, the nacre is white, and it has fairly well-developed laterals. European conchologists seem to have quite commonly mistaken heavy, large forms of *Unio batavus* for Retzius' species, and in a number of cases the *M. margaritifera* has been taken for it.

Ortmann, (l. c.), follows Kobelt, (Nachr. Bl. D. Ges., 1909, p. 43), in referring *Unio crassus* Retz. to the species commonly known as *Unio batavus*.

Haas, (Nachr. Bl. D. Ges., 1910, p. 181), has recently made this species the type of a new genus, *Pseudunio,* but, apparently, without sufficient reason.

MARGARITANA LAOSENSIS (Lea).

Shell elongated, arcuate, rather solid, not inflated, inequilateral; beaks slightly elevated, not full, their sculpture consisting of ridges that nearly follow the growth lines; posterior ridge high, very wide and rounded; anterior end of the shell rounded, posterior end a little wider, rounded or feebly pointed; surface with rude, concentric growth lines; epidermis brownish-green or greenish-brown and subshining in young shells, brown or blackish and dull in old ones; left valve with two small, stumpy pseudocardinals, the anterior one often almost obsolete, and two remote, small laterals; right valve with two pseudocardinals, the hinder rudimentary and one lateral; laterals granular and showing traces of vertical striation; muscle scars well impressed, the anterior ones rough, the posterior elliptical; nacre whitish or purplish, thickened in front, generally showing small pits.

Length 90, height 37, diam. 22 mm.

Laos Mountains, Cambodia; Siam; Burma.

Unio laosensis LEA, Pr. Ac. Nat. Sci. Phila., VII, 1863, p. 190; Jl. Ac. N. Sci. Phila., VI, 1866, p. XXI, fig. 61; Obs., XI, 1867, p. 67, pl. XXI, fig. 61.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLVII, fig. 256.

Margaron (Unio) laosensis LEA, Syn., 1870, p. 62.

Margaritana laosensis SIMPSON, Syn., 1900, p. 678.

Margaritanopsis laoensis, HAAS, Con. Cab., Unio, 1910, pl. XII, figs. 1, 2.

Unio sula THEOBALD (where?)

Smaller than *margaritifera,* with a higher and much wider posterior ridge and always having laterals. The nacre is much clearer than that of *margaritifera.* An undoubted *Margaritana* notwithstanding its peculiar geographical distribution.

Haas has recently, (Nachr. Deutsch. Mal. Ges., 1913, p. 33), made this species the type of a new genus, *Margaritanopsis.*

MARGARITANIA MONODONTA (Say).

Shell greatly elongated, arcuate, sometimes subinflated, inequilateral, subsolid to solid; beaks a little elevated but not inflated, their sculpture consisting of strong, straight ridges running parallel with the growth lines; posterior ridge full, curved and ending behind at the base of the shell in front of the hinder end; anterior and posterior ends rounded; surface sculptured with rude growth lines; epidermis greenish-brown and subshining in the young shell, blackish, thick and dull in old shells; pseudocardinals imperfect, generally reduced to a single imperfect spur or low tubercle in each valve of the old shells; laterals blurred and feeble; there are usually two in the left valve and one in the right; nacre white, granular and pitted; muscle scars impressed, the anterior ones rough, the posterior elliptical.

Length 172, height 53, diam. 38 mm.

Ohio; Cumberland, and Tennessee river systems; Illinois; eastern Iowa; Nebraska?

Type locality, Falls of the Ohio and Wabash River.

Unio monodonta SAY, N. Harm. Diss., II, 1829, p. 293.—SAY, Am. Conch., I, 1830, pl. IV.—CHENU, Bib. Conch., 1st. ser., III, 1845, p. 12, pl. II, fig. 1

Alasmodonta monodonta FERUSSAC, Guer. Mag., 1835, p. 26.

Margaritana monodonta CONRAD, Pr. Ac. N. Sci. Phila., VI, 1853, p. 262.—SIMPSON, Syn., 1900, p. 679.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 233, figs. 2, 2*a*.

Cumberlandia monodonta ORTMANN, Naut., XXVI, 1912, p. 13.

Unio monodontus SAY, Am. Conch., VI, 1834.—HANLEY, Biv. Shells, 1843, p. 210, pl. XXIII, fig. 48.—KUSTER, Conch. Cab., 1861, p. 221, pl. LXXV, fig. 1.

Margarita (Unio) monodontus LEA, Syn., 1836, p. 40; 1838, p. 26.

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

Unio soleniformis LEA, Tr. Am. Phil. Soc., IV, 1831, p. 87, pl. x, fig. 17; Obs., I, 1834, p. 97, pl. x, fig. 17.—CHENU, Ill. Conch., 1858, pl. XIV, figs. 4, 4*a*, 4*b*; Manual II, 1859, p. 137, fig. 661.—SOWERBY, Conch. Icon., XVI, 1866, pl. XLV, fig. 243.

Margaritana soleniformis PÆTEL, Conch. Sam., 1890, p. 173.

The anterior end of old shells is often much more solid than the posterior. Longer in proportion than any other *Margaritana*.

Dr. Ortmann (l. c.) has recently made this species the type of a new genus, *Cumberlandia*, which he separates from *Margaritana* on account of the greater development of the gill structure. He says: "While in other species of the genus *Margaritana* the interlaminar connections of the gills are scattered, and irregularly distributed, or fall into more or less distinct oblique rows, in the present species these irregular, interrupted rows are *developed as continuous septa, which run obliquely forwards*. In the middle of the gills these septa are well developed and quite continuous, but rather distinct from each other. Towards the ends of the gills they are more irregular, shorter and chiefly at the posterior end they are somewhat interrupted, and thus it is clearly seen that they represent a *further development* of the oblique, interrupted rows present in other species of *Margaritana*."

Group of *Margaritana decumbens*.

Shell trapezoidal, thin, compressed, pointed at the posterior base; hinge line sinuated.

MARGARITANA DECUMBENS (Lea).

Shell irregularly rhomboid or trapezoid, being narrowed in front and somewhat widened behind, compressed, scarcely subsolid, inequilateral, somewhat arcuate; beaks neither full

nor high, their sculpture not made out; hinge line sinuous, being incurved in front of the beaks; posterior ridge angulated, ending in a point behind at the base of the shell; surface with rude, uneven growth lines, brownish or yellowish-green, faintly rayed, dull and dirty; left valve with an imperfect, somewhat double pseudocardinal, and two feeble, curved laterals; right valve with two small pseudocardinals and an imperfect lateral; anterior scars slightly roughened; posterior scars elliptical; nacre purplish-tinted, rather bright, with a few pits.

Length 84, height 42, diam. 18 mm.

Type locality, Alabama.

Unio decumbens LEA, Pr. Ac. N. Sci. Phila., V, 1861, p. 40; Jl. Ac. N. Sci. Phila., 1862, p. 87, pl. XII, fig. 236; Obs., VIII, 1862, p. 91, pl. XII, fig. 236.—SOWERBY, Conch. Icon., XVI, 1868, pl. LXXXII, fig. 432.

Margaron (Unio) decumbens LEA, Syn., 1870, p. 62.

Margaritana decumbens SIMPSON, Syn., 1900, p. 679.

Quite different from the other species, yet having the characters of a *Margaritana*. It is a little strange that only the type is known of this curious compressed, rather thin, trapezoidal species.

Group of *Margaritana hembeli*.

Shell having its posterior part more or less corrugated.

MARGARITANA HEMBELI (Conrad).

Shell oblong, obovate to subrhomboid, sometimes a little arcuate, subsolid to solid, inequilateral; beaks moderately full, their sculpture not seen; posterior ridge low, rounded or somewhat double; anterior end rounded or subtruncate; posterior end feebly pointed below the median line and sometimes angled at the base; surface with rude, uneven growth lines; posterior end with more or less distinctly marked corrugated sculpture, often divaricately plicate; epidermis tawny-brownish or blackish; left valve with two low, stumpy, rough pseudocardinals and two remote, feeble laterals; right valve with one pseu-

docardinal and behind it a vestige of a second with one lateral; laterals granular with traces of vertical striation; muscle scars impressed, the anterior rough, the posterior elliptical; nacre whitish or lurid purplish with numerous pits.

Length 110, height 52, diam. 33 mm.

Length 83, height 40, diam. 22 mm.

Louisiana; Burnt Corn, Alabama.

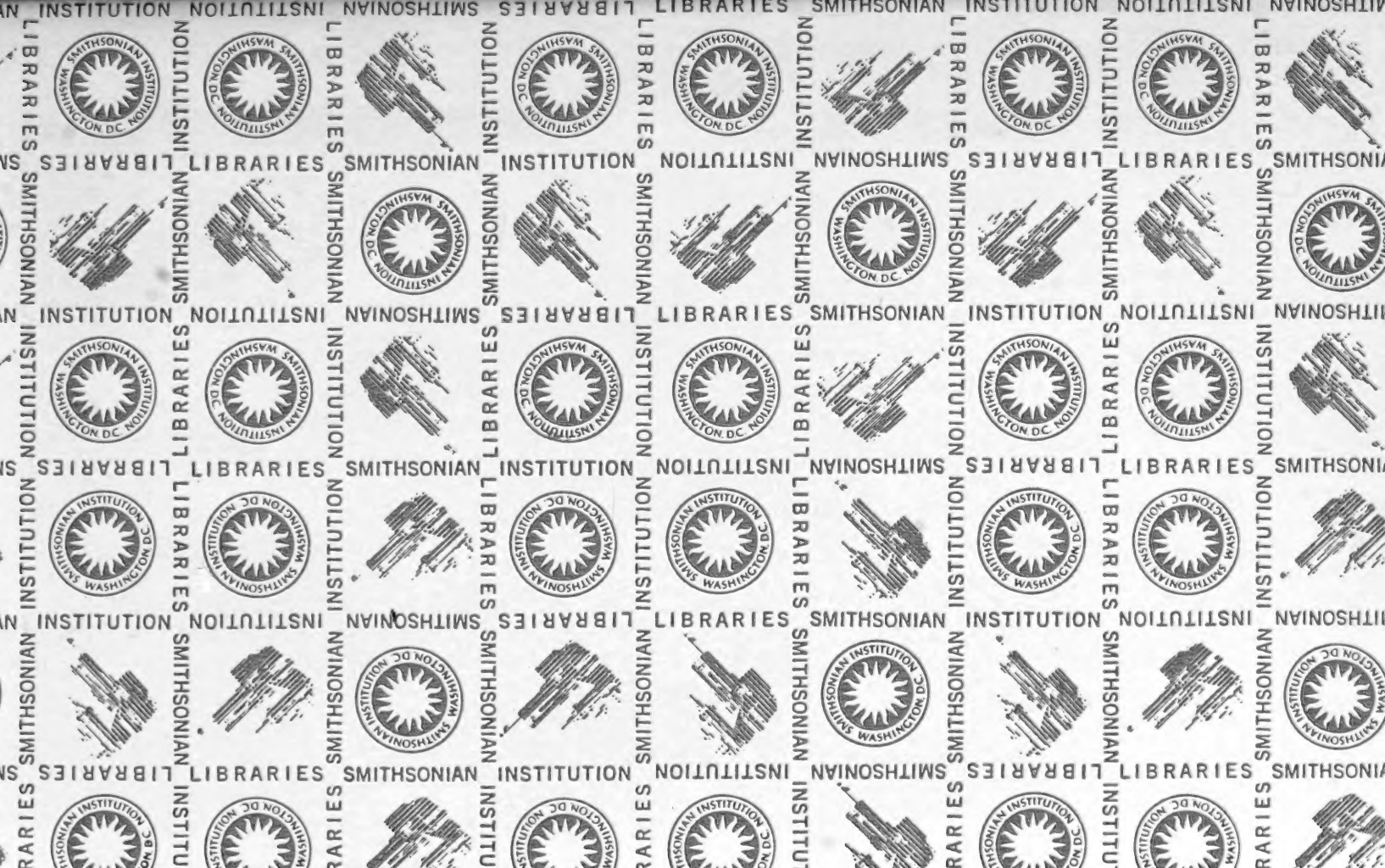
Type locality, New Orleans, La.?

Unio hembeli CONRAD, Monog., X, 1838, p. 93, pl. LI, fig. 1.—HANLEY, Biv. Shells, 1856, p. 383, pl. XXIV, fig. 3.—SOWERBY, Conch. Icon., XVI, 1866, pl. XXXIII, fig. 172.

Margaron (Unio) hembeli LEA, Syn., 1852, p. 21; 1870, p. 32.

Margaritana hembeli SIMPSON, Syn., 1900, p. 679.—ORTMANN, Ann. Car. Mus., VIII, 1912, p. 235, figs. 3, 3*a*.

The general form and texture, the teeth and scars in the cavities of the valves show this to be a *Margaritana* rather than an *Unio*. I have examined the animal, which is dark and has the posterior ends of the gills free as is that of *M. margaritifera*. Specimens from Burnt Corn, Alabama, are strongly, corrugately plicate on the posterior slope and from the posterior ridge fainter radial ridges sweep forward and downward. Some of the shells from near New Orleans are almost smooth.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